FEBRUARY 20, 1961

American Machinist / Metalworking Manufacturing

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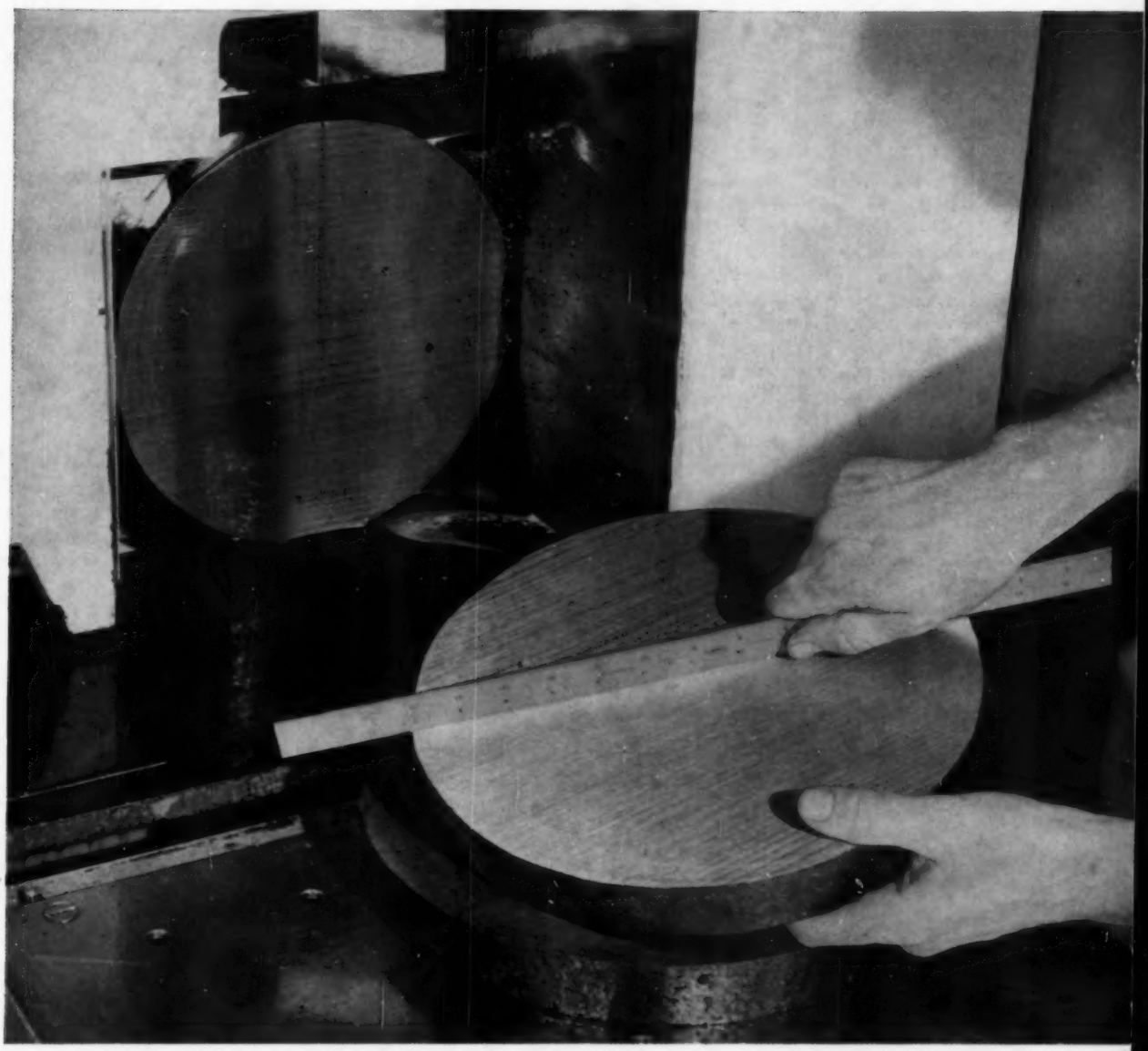

How to cut bandsawing costs—see page 94

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- New way to make honeycomb, p100
- Productivity indexes, p105
- Rolled worm threads, p108
- Job shop order handling, p114
- Finishing to a micro-inch, p118

UNIVERSAL GRINDING

Reversing the Cost Trend

by Clifford G. Menard
Consulting Engineer
The Heald Machine Company

Just about everything costs *more* these days—*much* more than it did 10 or 15 years ago. And when we first decided to build a completely new Universal Internal Grinding Machine that would not only "hold the line", but actually *reverse* the upward cost trend, many an eyebrow was lifted in disbelief. Some said it couldn't be done. Others felt that major economies could be made only with a big sacrifice in performance.

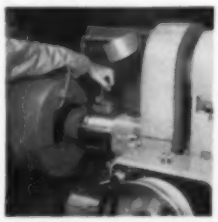
Admittedly, the task was not a simple one. In order to cut costs without cutting quality, we had to make a complete re-evaluation not only of the basic machine design, but of every step of our manufacturing operations as well. But we found that a large number of cost savings could be made, by utilizing the latest advances in machine design and streamlining production methods to eliminate as many manual operations as possible. Although most of the savings were relatively small individually, they added up to a major reduction in manufacturing cost.

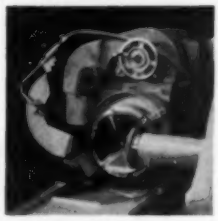
This better, more versatile general purpose grinder costs about *half* as much as comparable machines today, and *less* than similar machines (with fewer features) cost in 1947!

Here's how some of the savings were made. The use of hydrostatic table ways eliminated an expensive booster arrangement in the hand table feed. An externally-mounted valve "package", on the front of the machine, simplified the hydraulic power arrangement and eliminated all but essential units in the hydraulic system. And with all hydraulics outside of the machine, the base is mechanically stronger and less expensive to produce because there are fewer holes and less surface area to finish. Furthermore, simplified basic engineering and construction make it possible to build this standard machine with standard arrangement on a STOCK basis resulting in shorter deliveries.

These and other refinements enabled us to make the 273A a truly universal machine with greater capacity, easier operation, and inherent precision that holds tolerances within .0001" in normal production and .000050" in special cases. Yet its 1947 price tag puts it within the economic reach of virtually every plant or machine shop, regardless of size.

Here's the new Model 273A Universal, on display at the 1960 Machine Tool Exposition. On a steel test piece, the O.D., a straight bore, a tapered bore and the face were ground to size within .0001" at a single chucking.





Workhead swivel of 90°, several wheelhead positions, permit I.D., O.D. and rotary surface grinding of parts up to 12" in diameter. Vari-speed workhead drive is infinitely adjustable from 75 to 450 rpm.

Ask your Heald Engineer for the complete UNIVERSAL story. Then compare its performance and cost with any other similar machine available today!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts

CIRCLE 151 READER SERVICE CARD

COVER:

Checking slug cut on bandsaw at Continental Machines where cost per cut has been reduced by faster cutting. See page 94.

American Machinist / *Metalworking Manufacturing*

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How to cut bandsawing costs . . . Lowest cost comes by finding top speed at which accuracy can be maintained. Here's how. *By Charles Cleland, Continental Machines Inc* **94**

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How to design rolled worm threads . . . What you need to know about thread-roll design and material selection for good worm-thread design. *By E C Hanna, Landis Machine Co* **108**

Job shop speeds order processing . . . Associated Spring cut time to handle orders up to 75%. Here in detail is the new system. *By Tom Johnson* **114**

Finishing to a microinch . . . Rotary lapping does most of the work in this watch plant. *By Eric Sieke, Bulova Watch Co* **118**

Shop Shots . . . Bending job at Boeing, automatic welder at Temco, special drill at Perma-Lite Raybern **120**

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How to Work Laminated Plastics and Fiber, I, II . . . *By John T Bishop, Continental-Diamond Fibre Corp* **123**

TURN PAGE FOR METALWORKING REPORT—→

METALWORKING REPORT

. . . what's new and significant in manufacturing techniques and materials—direct from our own staff and round-the-world news bureaus

CUTTING . . . New approach to numerical control, developed by Barber-Colman for their Taper-guide lathe, uses tape for two purposes. Not only does the tape store data; **sprocket holes of the tape serve as a common denominator** for coordination of input data. More details about the lathe, which **cuts over 700 step-free tapers** with its largely mechanical control system, will be found on p139.

MANUFACTURING CONTROL . . . Orders now get processed three to five times faster than before in the plants of a major spring maker. Behind the speed-up is a paperwork-simplification program that radically reduces waste and duplication. **The system is flexible, will work in any size plant.** For complete details, see the story that begins on p114.

MATERIALS . . . Rocket-motor test nozzles now last for several solid-propellant firings because their throats are coated with plasma-arc-sprayed alumina at Rocketdyne Div, North American Aviation, McGregor, Tex. An **0.00125-in. thick alumina coat,** which is applied for about $10, permits the $75 to $80-nozzles, made of AISI 1020 steel, to **withstand 5500 F during short-duration, solid-propellant firings.**

FORMING . . . Embossed patterns can be applied to roll-formed shapes of stainless steel, aluminum, and anodized aluminum. According to Roll Formed Products Co, Youngstown, Ohio, the **pattern does not hinder notching or punching** the stock, and design can be applied without breaks in pattern. **Cost: only the embossing die.**

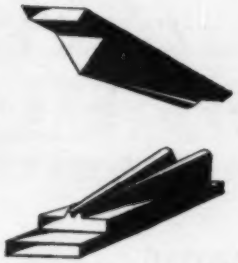
MANUFACTURING CONTROL . . . Coded design data from a computer now can produce mechanical drawings of a part directly—in less than ½ second. After a microfilm recorder (from Stromberg-Carlson) receives the code, **an electron beam draws lines, symbols,** and dimensions on a latent-image TV screen. A camera photographs the image. The same computer code **can also produce tapes to control machines** that make the part. Details will be found on p102.

COMPONENTS . . . Shafts ride on an air cushion in Chrysler's new Hydro-Static air bearing because air is forced through its powdered-metal structure. Developed in an Air Force research project, **the bearing is made of porous Oilite,** the same powder-metal material used in oil-impregnated sleeve bearings. Another variation is a Hydro-Dynamic bearing—not made of Oilite—that **has a mechanical offset wedge from which air is drawn as the shaft rotates.** Unlike the first design, it requires no pressurized air.

FINISHING . . . A special roller-coater applies a seamless, corrosion-resistant lining of Goodrich Geon vinyl to the inside walls of steel pipe at Lithcote Corp. Coatings between 1/16 and 1/8-in. thick can be applied to pipe 3 to 36 in. in diameter, up to 60 ft long. After coating, the **plastisol is fused to pipe walls by heating in a special oven.**

MATERIALS . . . Attaching a small piece of platinum prevents hydrogen embrittlement of tantalum parts. Working as a "hydrogen sponge," platinum is effective when ratio to tantalum is only 1:10,000. Scientists at the Metals Research Labs of Union Carbide Metals, Niagara Falls, NY, made the discovery, which is **expected to be particularly significant to chemical equipment makers.**

INSPECTION . . . Four wedge sets measure all unified threads between 4½ and 40 tpi, except for specialized cases, which are covered by four additional sets. Developed by the Inspectorate of Armaments, Woolwich, London, these thread wedges are claimed to **overcome inaccuracies in screw thread measurement by conventional cylinders** because small-range, high-magnification comparators eliminate errors introduced by large-range micrometers. The wedges are developed from 60° prisms which are increasingly truncated.



FORMING . . . A new transfer press for mo'ding plastics has fully automatic operation. form hex nuts for aircraft-quality flareless tube fittings at less than 2/3 the cost of totally machined parts. Developed for the Air Force, this **full-production setup gives a 55% extrusion reduction during backward extrusion** of 1-in. diameter slugs, ⅝-in. thick. The starting slug weighs only half that of one needed for screw machining; also, it can be **cut from round barstock instead of more expensive hexagonal.**

FORMING . . . A new transfer press for molding plastics has fully automatic operation. Preforms are fed into the preheater, then moved into the molding area. **Cull and runners are separated from finished parts.** F J Stokes Corp, Philadelphia, has delivered the automatic, 200-ton press to a Midwest manufacturer of electrical switches.

FINISHING . . . New tinning dip uses no electricity, contains no cyanide, and operates at lower temperatures than previous hot dips. Cuposit LT-26, developed by Shipley Co, Wellesley, Mass, is **said to be completely stable** and to produce a protective tin coat with a quick dip. Because the pure tin coating has good bond and sufficient depth for fusion, the chemical **should eliminate many soldering problems.** Tin is not deposited on nonconductive surfaces; therefore, **dielectric properties are not changed.**

MATERIALS . . . Steady-state magnetic fields of 88,000 gauss, or more, are possible with a new superconducting compound of niobium and tin (Nb_3Sn) at 18 Kelvin. **Developed through cryogenic research** at Bell Telephone Laboratories, it can be applied in communications, plasma control, and other high-magnetic-field equipment.

Continued on next page

Coming in AM/MM

- *Five Ways to Hold Flat Parts*
- *Tapping With Electrical Discharge Machines*

METALWORKING REPORT . . .

WELDING . . . Automatic pipeline welder joins the ends of 8-in. pipe in one minute, with a 3-man team. After an air-driven abrasive cutting wheel trims both ends, the **arc welder makes two circular sweeps around the pipe.** Designed and tested for 4 to 8-in. pipe, the unit **can be adapted to pipe 30-in. or larger.** Battelle Memorial Institute and Air Reduction Sales Corp worked on a project sponsored by Esso Research & Engineering Co.

CUTTING . . . Turning and facing can be done on Cross Transfer-matics with standardized, building-block facing units. Each station of the 3-station facing unit has an expandable arbor that grips in a previously drilled hole in a transmission case so that **opposed faces on three cases can be faced at the same time,** with faced surfaces square with the holes within 0.0035 in. TIR. **The facing operation includes an interrupted cut.** Units may be fitted for drilling, facing, turning, grooving, or broaching.

HEAT TREATING . . . A new quenching oil will eliminate many finishing operations because, unlike other high-quench-power oils, **it doesn't stain or discolor metals as it cools.** Voluta 921, developed by Shell Oil Co's Wood River (Ill) Research Laboratory, **combines rapid quenching with maximum retention of brightness.** A potential market for over 2,000,000 gal/yr (about 15% of the quenching-oil market) is estimated by Shell.

COMPONENTS . . . A photoelectric system detects tiny objects and minute movements when the Pinpoint, made by Farmer Electric Products Co, Inc, is attached to it. On the photocell, this device **narrows the scanner's field of vision** so that it can detect small objects up to 10 ft away and **recognize movement as low as 0.001 in.** On the light source, the Pinpoint produces a small, sharply defined round spot (1/64-in.-dia at ¼ in. from lens); hence, it will **detect 0.010-in.-dia objects or even follow lines in a tracing operation.**

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introduces a New

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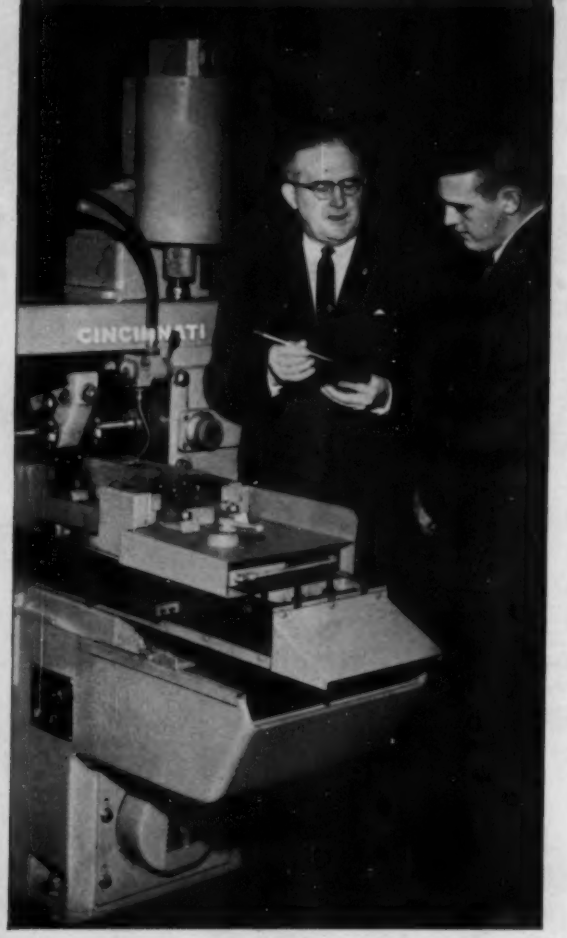
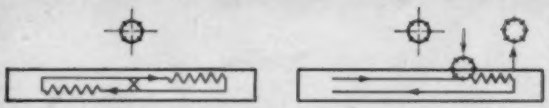
Powermatic

MILLING MACHINE





Plain Automatic

Automatic Rise-and-Fall

Jack Lynch (left in photo), Manager of Milling Machine Sales, points out the advantages of a new Powermatic Rise-and-Fall in milling the bottom profile of shotgun frames.

...for intermediate range automatic milling

The newest Cincinnati bed type... the Powermatic... fills the need for a fast, automatic medium-duty milling machine equipped to handle job shop quantities as well as high-volume work.

The Powermatic is built in two styles: Plain Automatic (automatic cycles for the table only) and Automatic Rise-and-Fall (automatic cycles for the table and spindle carrier). In addition to the usual types of operations, the Automatic Rise-and-Fall style may be equipped to perform: (1) contour milling within 30° rise from the horizontal, and (2) box milling, or jobs which require feeding up. And to help you devise the most efficient tooling, Cincinnati offers the unmatched experience of their Engineering Service Department.

Cincinnati's experience with bed types extends over a period of nearly 50 years, so it's natural that Cincinnati should build the finest of all types. Now turn the page and you'll see more Powermatic feature-advantages and their relation to profit-making possibilities. Take a good long look; you'll agree that these fine milling machines are well worth your immediate attention. **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.** ➤➤➤➤➤➤➤➤➤➤➤➤

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MILLING MACHINE DIVISION

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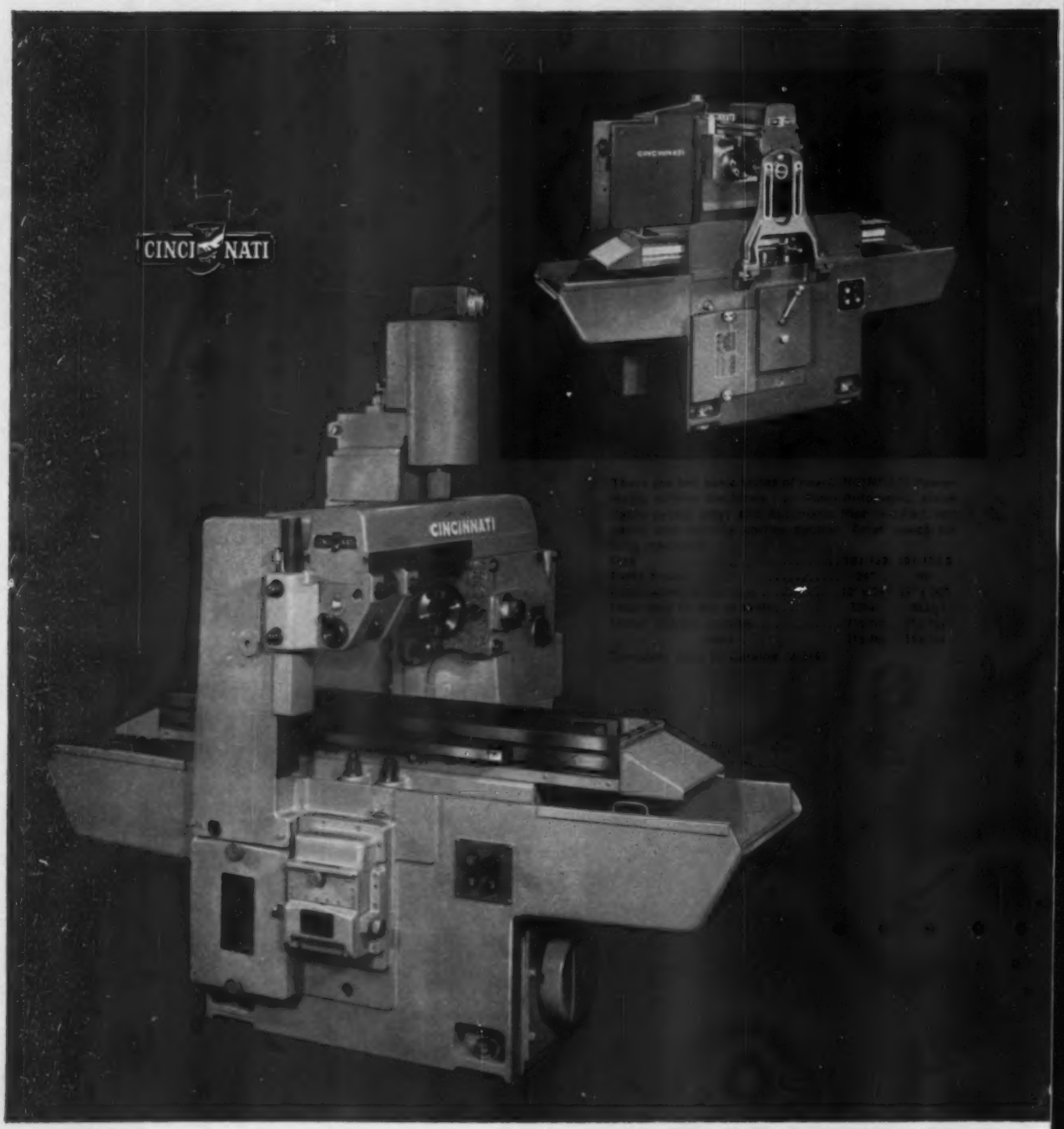

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THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

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Powermatics

Combine Convenient Setup with Bed Type Productivity

In the milling segment of machining, bed type design and high productivity go together. New CINCINNATI Powermatics add a new dimension —*convenient setup*—to this traditional relation. Some of the ways in which these new machines measure up to the highest standards of performance include:

Automatic two-way table cycles . . . a production advantage for reciprocal milling setups.

Automatic backlash eliminator . . . a necessary feature for "down" or "climb" milling and reciprocal setups.

One integral casting for the front base and column . . . assures maximum rigidity for full hp cuts.

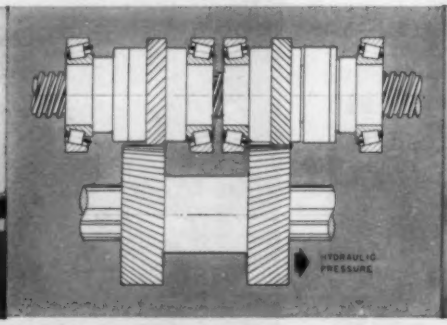
Table feeds and spindle speeds easily changed . . . simple pick-off gears; no wrenches required.

Single lever control . . . starts the complete automatic cycle.

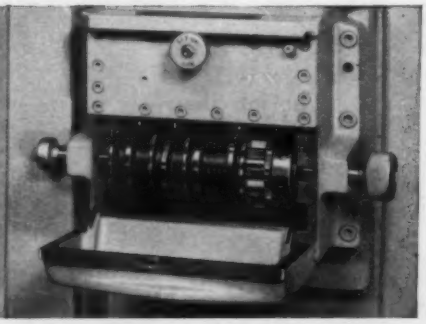
- *Effective chip and cutting fluid collecting system* . . . chip pans easily removed when full.
- *Dynapoise overarm* . . . damps chatter, thereby allowing highest feed rates to be used.
- *Automatic Rise-and-Fall style* . . . spindle carrier feeds down 1″ to 40″ per min.; rapid up and down; vertical cycles synchronized with table cycles; cycle selectors, readily interchanged, control sequence of events.

Many additional feature-advantages give new CINCINNATI Powermatics the highest cost-reducing potential for medium-duty work, in high-volume and medium-volume shops. Get more information by asking for a copy of Catalog M-2167. **Milling Machine Division, The Cincinnati Milling Machine Co.,** *Telephone RE 1-2121.*

Clean floors . . . easily removed chip pans at ends of bed keep the floor dry and clean. Cutting fluid returns to reservoir through perforations in bottom of pan.



Automatic compensation . . . for wear between table feed screw and nut; a prime feature-advantage for reciprocal setups and "down" milling.



Program director . . . the cycle selector is a simple camshaft unit. It controls sequence of events in automatic cycle. Can be interchanged in a minute or less.

VERTICAL BROACHING MACHINES • ELECTRICAL MACHINING EQUIPMENT

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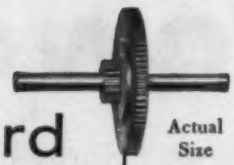

Actual Size

now you can check & record fine-pitch gear accuracy

at 1600 magnifications

on the No. 4 Fellows Red Liner

Now, the No. 4 Red Liner makes "composite" checks on the finest instrument gears with unbelievable accuracy and sensitivity. 1600 to 1 magnifications are obtained with the electrical recording system which gives a written, unbiased record for instant reading or for proof-of-accuracy files.

One report states — "11 teeth, 200 D. P. pinion backed up to a 100 tooth gear on a cluster, checked easily on the No. 4 Red Liner."

The job shown is 96 pitch with 22 teeth on the small gear and 80 teeth on the larger gear. The pinion shaft rides in vees in a turret-type fixture.

Fellows inspection units cover a range from the tiniest instrument gear up to some that are 24 inches in diameter.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
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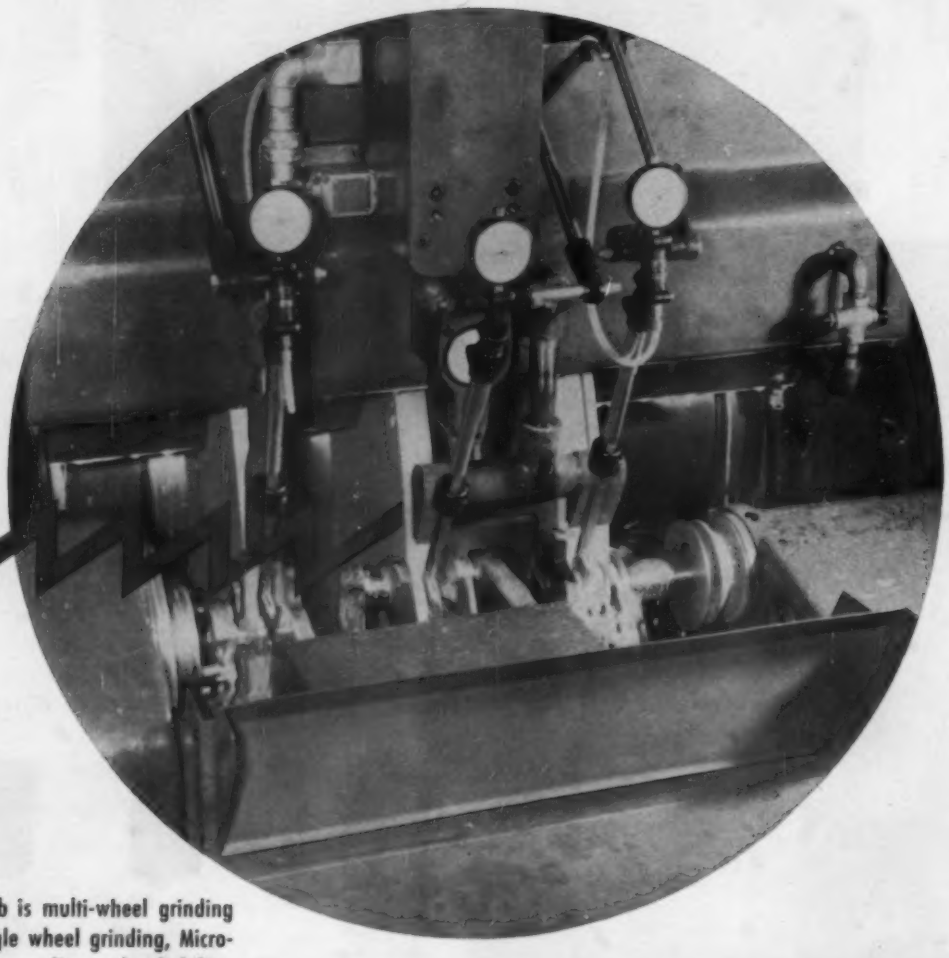
Automatic Race grinder

10″ R Plain grinder

14″ IWR Multiple Wheel grinder

Landis production grinders with Microfeed®



Whether your job is multi-wheel grinding like this, or single wheel grinding, Microfeed will assure quality and reliability.

typical Microfeed applications

tapered bearing race
specified size tolerance: .0002″

multiple diameter shaft
specified size tolerances: .0001″

Automatic Plunge grinder

Automatic Crankpin grinder

deliver closer tolerances consistently

Microfeed

- a new Landis precision wheelfeed that is a major breakthru in size control
- specified on new Landis grinders, Microfeed assures cylindrical grinding precision to your specified tolerances on a production basis
- automatically cancels all variables affecting work size

LANDIS

world leader in precision grinders

LANDIS TOOL COMPANY, WAYNESBORO, PA.

crankshaft line bearings
specified size tolerances: .0005"

steering knuckle
specified size tolerance: .0006"

crankshaft pins
specified size tolerances: .0005"

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AND

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HARDINGE BROTHERS, INC., ELMIRA, N. Y.

Landis 10" x 15" hand operated surface grinder with wet grinding attachment

NEW Landis 10" x 15" surface grinder has greater stability for tighter tolerances on tool and die work and small lot grinding

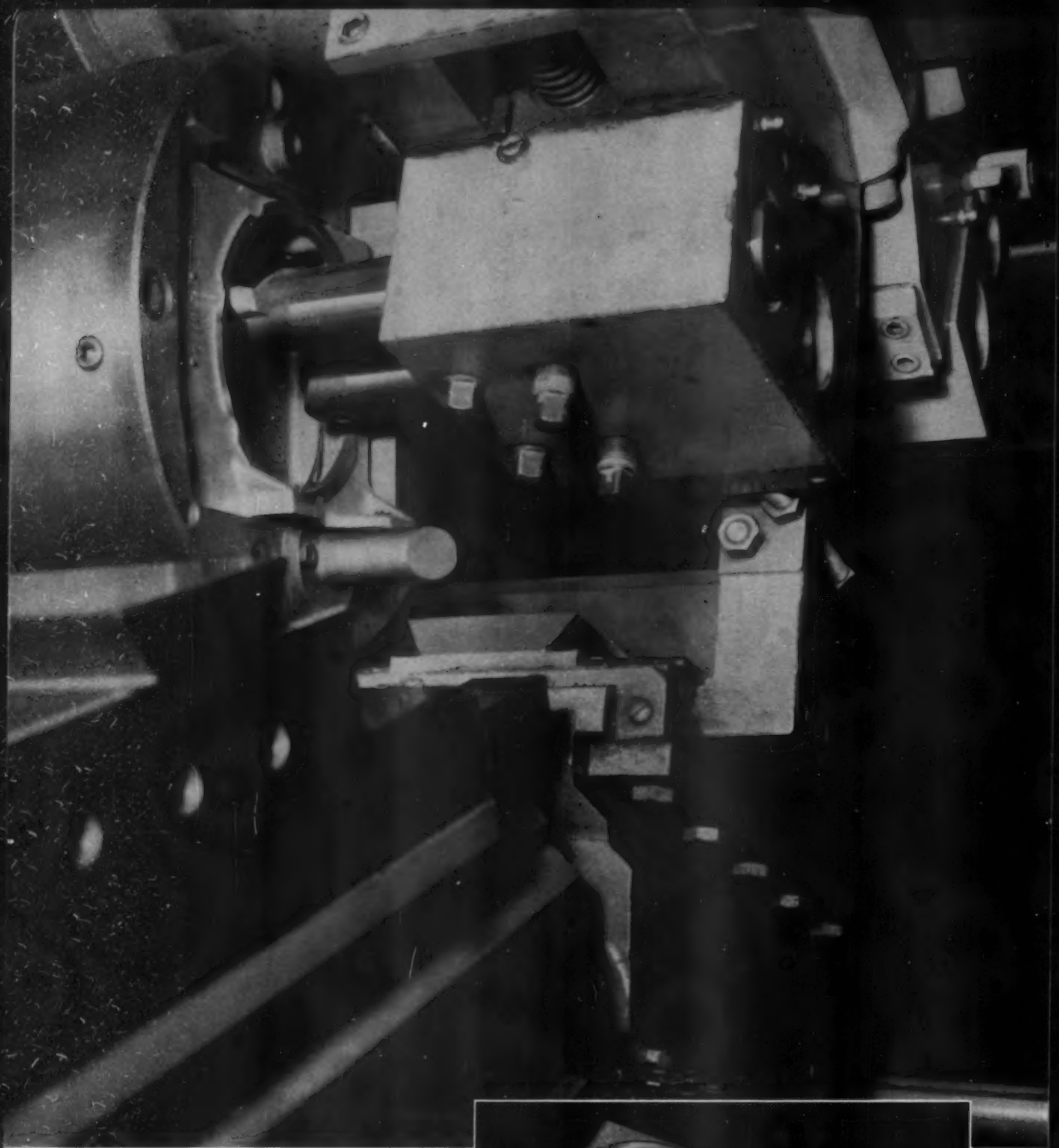
brief specifications

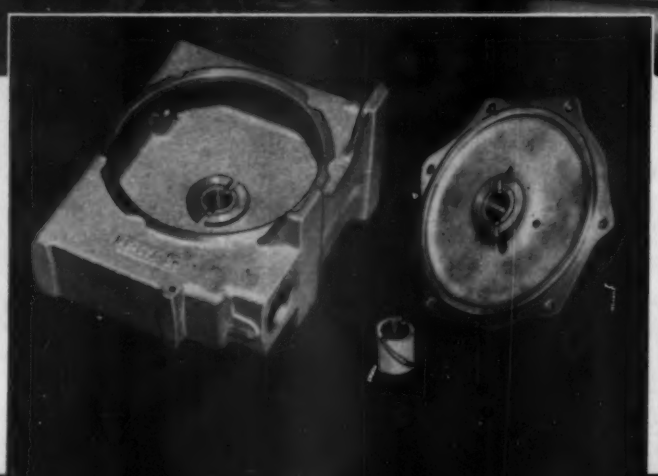
Work surface	10" x 15"
Table traverse	17"
Saddle movement	11¼"
Vertical capacity	12"
Grinding wheel	12" dia.
Spindle drive motor	1 hp

LANDIS

PRECISION PRODUCTION EQUIPMENT

LANDIS TOOL COMPANY, WAYNESBORO, PA.



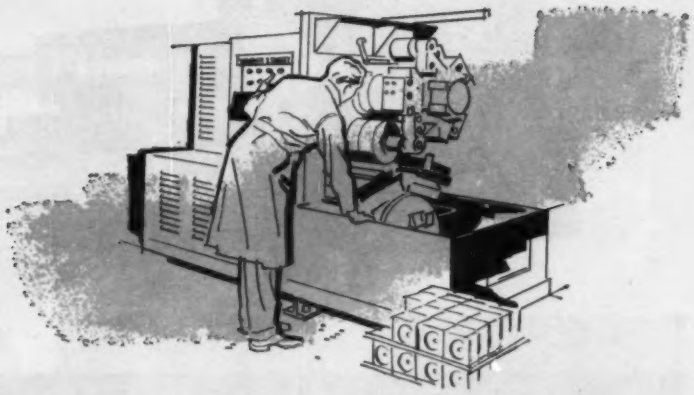


Lot sizes range from 100 to 300 pieces on these cast iron gear cases and covers. Note requirement for radial alignment of bushing so that its oil groove and the oil hole in the case will match properly. This is accomplished automatically in the job cycle.

CIRCLE 163 READER SERVICE CARD

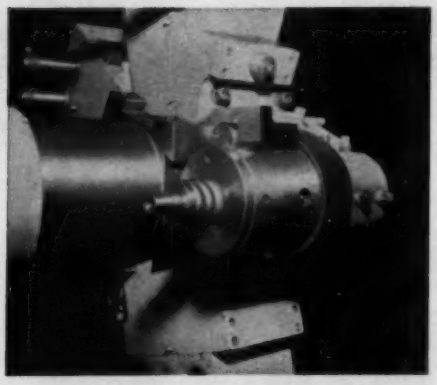
AT GENERAL MACHINE COMPANY

Emmaus, Pa.



.0006" repetitive accuracy held by 2AC Chucking Automatic

Seven operations reduced to two on gear case and cover by unvarying size control and automatic assembly of ported bushing during machining cycle.



Bushing loading tool is engaged by an arm on the fixture so that the correct radial relationship is established between the bushing and gear case. Easy placement of multiple feed and speed change dogs in the machine permit reduced rate of engagement for gentle pick up, then fast return to bushing assembly stroke of tool slide.

Because of the unique overhead turret design of the Warner & Swasey 2AC, which houses both turret and spindle bearings in the same temperature zone, size variations due to spindle rise are eliminated. As a result, the shop people at General Machine found that they could easily hold single point boring tolerances of .0006" on a day-to-day basis.

This exceptional repetitive accuracy plus the 2AC's unique versatility and ease of tooling permitted them to machine gear cases and covers complete, ready for paint *in just two operations*—one chucking for each part, including pressing-in and size-boring a bronze bushing. Previously, seven operations were required—two machining, two arbor press, assembly of cover to case, line ream, and disassembly.

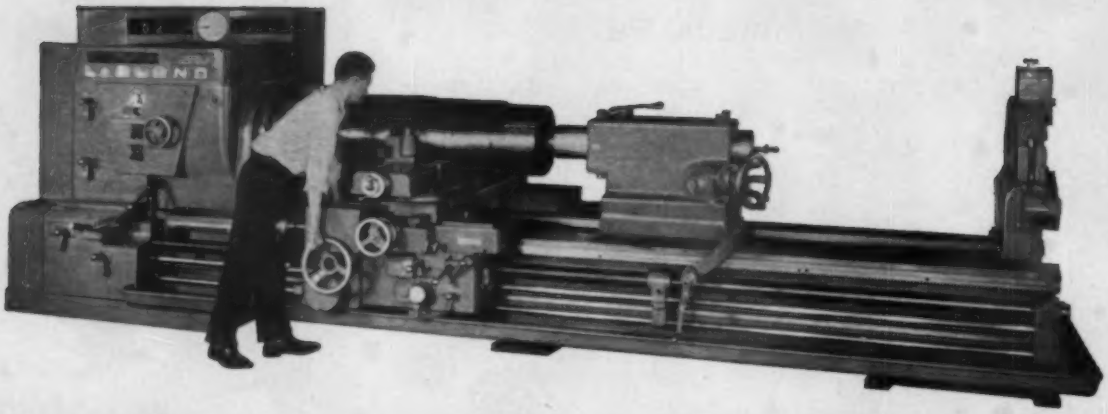
Five operations plus part handling and related paper work were eliminated!

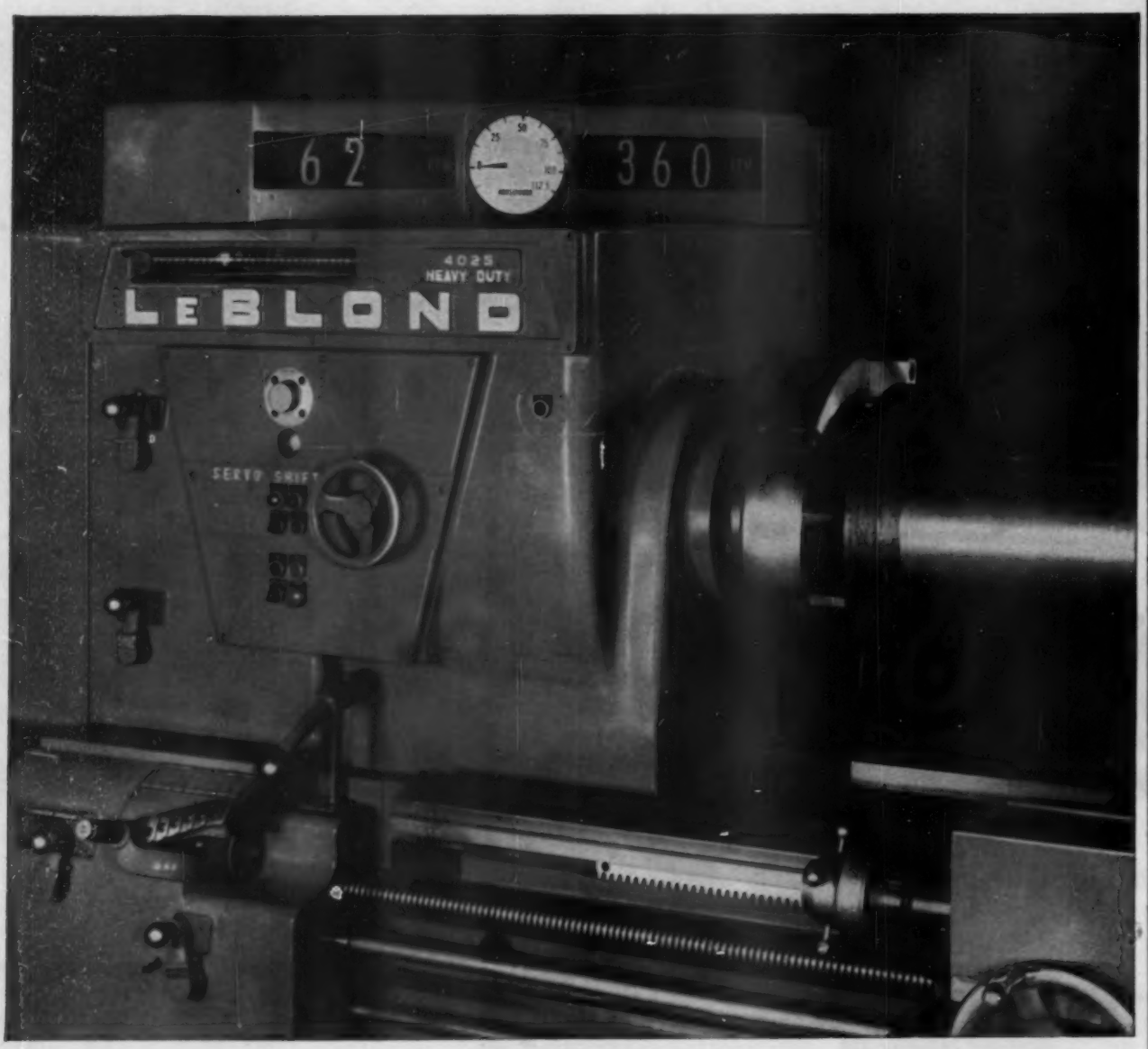
Warner & Swasey Single Spindle Automatics can cut costs on your chucking work, too. Consult with your resident Field Engineer. Warner & Swasey Company, Cleveland 3, Ohio.

YOU CAN TURN IT BETTER, FASTER,
FOR LESS...WITH A WARNER & SWASEY

WARNER & SWASEY

CIRCLE 164 READER SERVICE CARD




62
360
4025
HEAVY DUTY
LEBLOND

THE R. K. LeBLOND MACHINE TOOL CO. *World's Largest Builder of a Complete Line of Lathes*
Cincinnati 8, Ohio

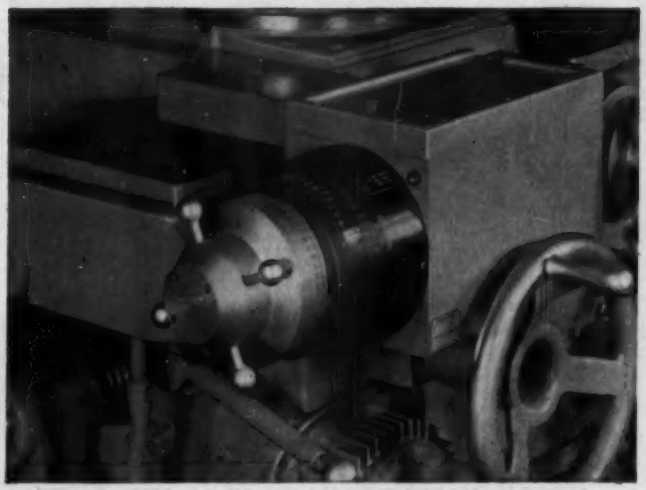
LeBLOND of Cincinnati

SERVO-SHIFT

BY

LeBLOND

More Production with Less Effort



You'll never need an operator with blacksmith muscles and an adding machine mind!

TOUCH A BUTTON on the carriage: This new LeBlond 4025 Heavy Duty slows, shifts, and picks up speed again in a new gear range, automatically. That's Servo-Shift doing the heavy work. No running to the headstock. No straining at balky levers. No wasted time.

TURN THE DRUM DIAL on the carriage to preselect spindle speed or surface speed. Set one, you automatically get the other for any diameter, fed in automatically from the gear train and cross slide position. No slide rules needed. No calculations. No errors.

BIG ILLUMINATED NUMBERS—Digital Readout—show sfm and rpm atop the lathe where everybody can see what's going on. No question now about when to push the Servo-Shift button for the next speed range. This readout tells. You get the cutting rates you specify. Rates you can plan on.

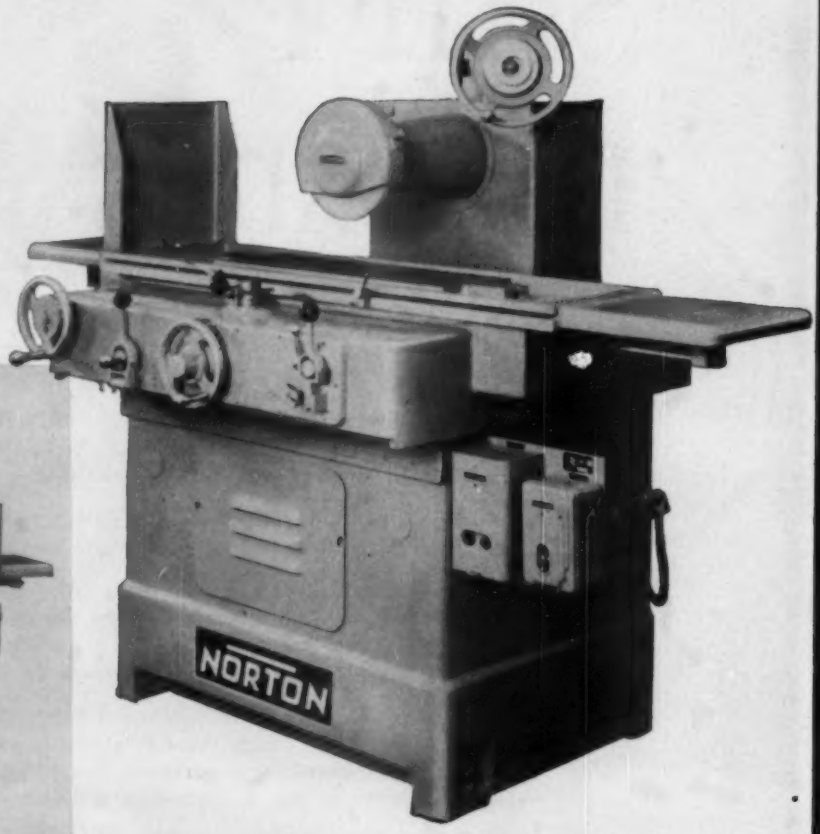
IT'S ALL NEW, right down to the sensible bed that slides chips out the back for easy clean up, and the remotely shifted gear train that provides 36 speeds in geometric steps from 5 to 600 rpm—6000 sfm at the periphery of a 40" diameter workpiece. Everything's safety interlocked by a closed loop system to prevent any chance of gear damage, important with 75 hp.

And under the electromechanical wizardry, this LeBlond 4025 (and other models to come) is as fine a heavy-duty lathe as money can buy. You'll assign it the big work, heavy shafts, roll turning jobs with or without a LeBlond 90° tracer, and you'll value the way it speeds production. Ask your LeBlond representative about the LeBlond 4025 Servo-Shift today.

Now... Type S-3 surface with 150 *fpm* table

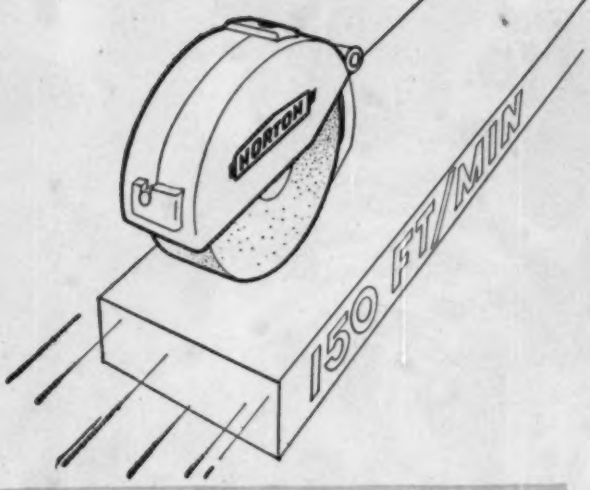
for faster production than ever before!

Available in 6" x 18" and 8" x 24" sizes. Both sizes are equally fast, cool, accurate on long production runs or a wide variety of toolroom grinding. Taller workpieces are easily handled by the 15" vertical capacity of the 6" S-3, and 13¼" capacity of the 8" S-3 Grinder. Other job-proved features include a two-speed .0001" increment hand wheel, assuring accurate vertical speed and fast positioning . . . contoured splash guards, for better sighting and loading.



NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

grinders speed...



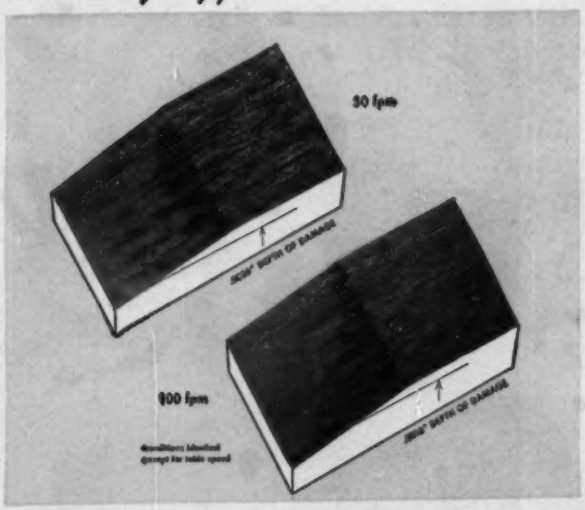
Long popular for their pace-setting table speeds up to 125 feet per minute, Norton Type S-3 surface grinders have given complete proof of their ability to finish workpieces smoother, faster, at lower cost.

Now S-3 grinders are also available with table speed stepped up to a new high of 150 feet per minute — enabling you to finish flat faster than ever, with cool-running action that saves time and money on every job.

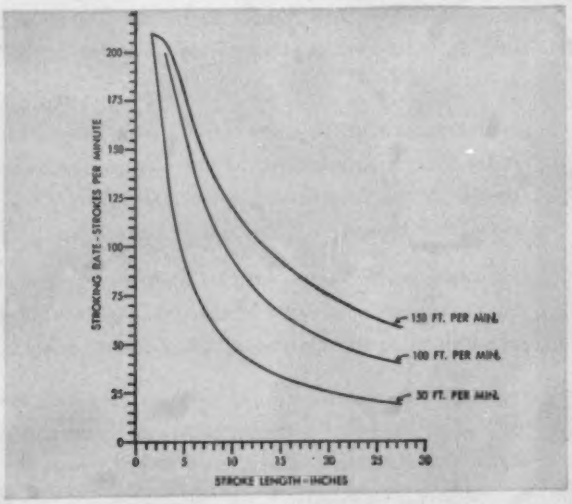
Get the whole story from your Norton Man, a trained specialist who can help you get better grinds at lower cost. Or ask for Catalogs 1982 and 2128. NORTON COMPANY, Machine Tool Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. *In Canada:* J. H. Ryder Machinery Co, Ltd., Toronto 5.

NORTON
MACHINE TOOLS

75 years of... Making better products ...to make your products better



You Get Better Quality Work with Norton Type S-3 surface grinders, thanks to their faster table speeds, which reduce heat damage. The above test samples show how faster table speeds result in cooler grinding.



Calculate Your Savings from this production rate chart. Grinding time is reduced in proportion to the increase in stroking rate. The higher speeds also greatly increase the rate of stock removal.

MACHINE TOOL DIVISION: Grinding and Lapping Machines — **S & E DIVISION:** Shapers • Gear Cutting Machines • Gear Induction Hardeners

to make your short runs practical and profitable buy the new cost cutting

GRAY

equipped with space-setter readout numerical control

time saving: The Gray Space-Setter system readout provides a basic and infallible counting or measuring system. The zero offset feature establishes zero readout at any pre-determined reference point on the workpiece. Operator can read drawing dimensions on panel.

greater accuracy: The Space-Setter system allows accuracies to within .001". It is unaffected by line voltage. The precision construction of the Gray horizontal bar takes full advantage of the Space-Setter system.

fast change-over: More effective machine tool productivity is possible through elimination of costly tooling, thus providing opportunities to be found in previously unprofitable or complex work.

profitable: To hold costs in line on short runs while maintaining the highest degree of accuracy, GRAY horizontal boring, drilling and milling machine is the greatest money maker in the field, proving that Quality doesn't cost — it pays.

The G. A. Gray Co / Cincinnati / Ohio

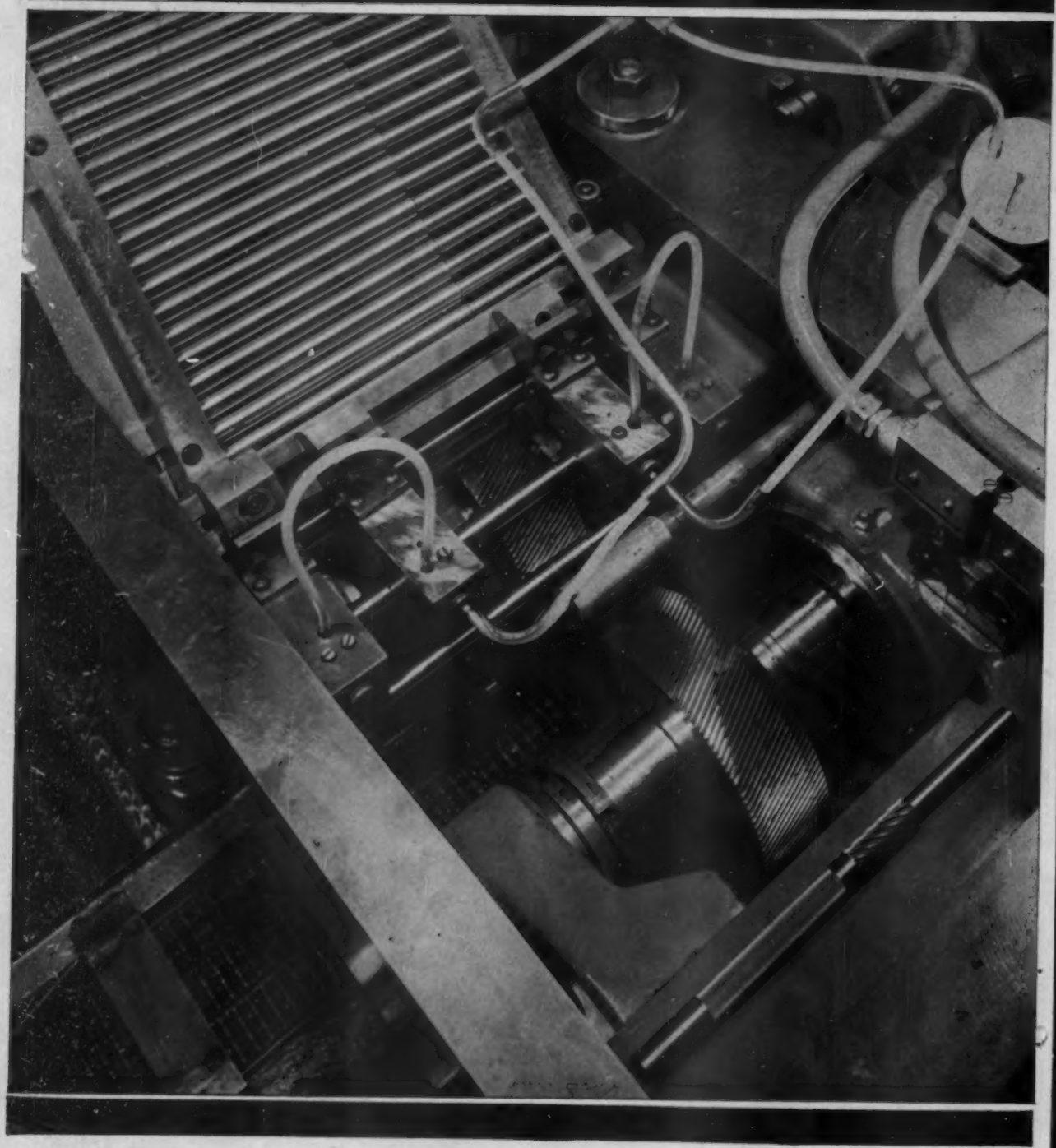
horizontal milling and boring machines
planers
planer type milling machines

The Job:
machining ball mill
made by
Brighton Corp., Cincinnati.

CIRCLE 170 READER SERVICE CARD

GRAY
GRAY
GRAY

LANDIS *thread rolling machines*



prove versatility at CHRYSLER CORP.

Two highly versatile LANHYROL Thread Rolling Machines have proven their worth thread rolling both the spline and knurl on starter motor armature shafts at the Chrysler Corp. Electrical Equipment Plant, Indianapolis, Indiana.

In this operation, the two LANHYROL Machines are completely automatic with the workpieces being rolled by the infeed method with electro-pneumatic die cycling (see accompanying specifications and illustration).

Due to the versatility of the LANHYROL Machine cost-saving benefits result. For instance, if you were to select the thread rolling process and perform the thread rolling on the high-production LANHYROL, you undoubtedly would realize savings in the following ways:

1. One LANHYROL often can supplant two or more thread milling, hobbing or grinding machines to result in reduced handling and machine maintenance costs. A reduction in the overall per piece cost in terms of floor space needed to produce the product is also realized.

2. There is a material savings. Thread rolling offers substantial material savings since it generally requires less material than is required to produce a thread, gear or spline form by any other method.

3. Heat-treating is eliminated. The LANHYROL Machine produces strong, accurate threads of excellent finish in a chipless cold-forming process. Thus, thread rolling can often result in a sufficient work hardening of the workpiece and eliminates the need for subsequent heat-treating.

Adapted for manual, semi-automatic or automatic operations, the LANHYROL Machine can be used to thread a variety of forms (whether by the infeed, thrufeed, continuous or reciprocal methods) simply by using proper dies and tooling. Its power, versatility and 0 to 3" diametrical range capacity make it the most useful and productive thread rolling machine available. For further information send your specifications and ask for Bulletin E-60.

SPECIFICATIONS

Workpiece Specifications:

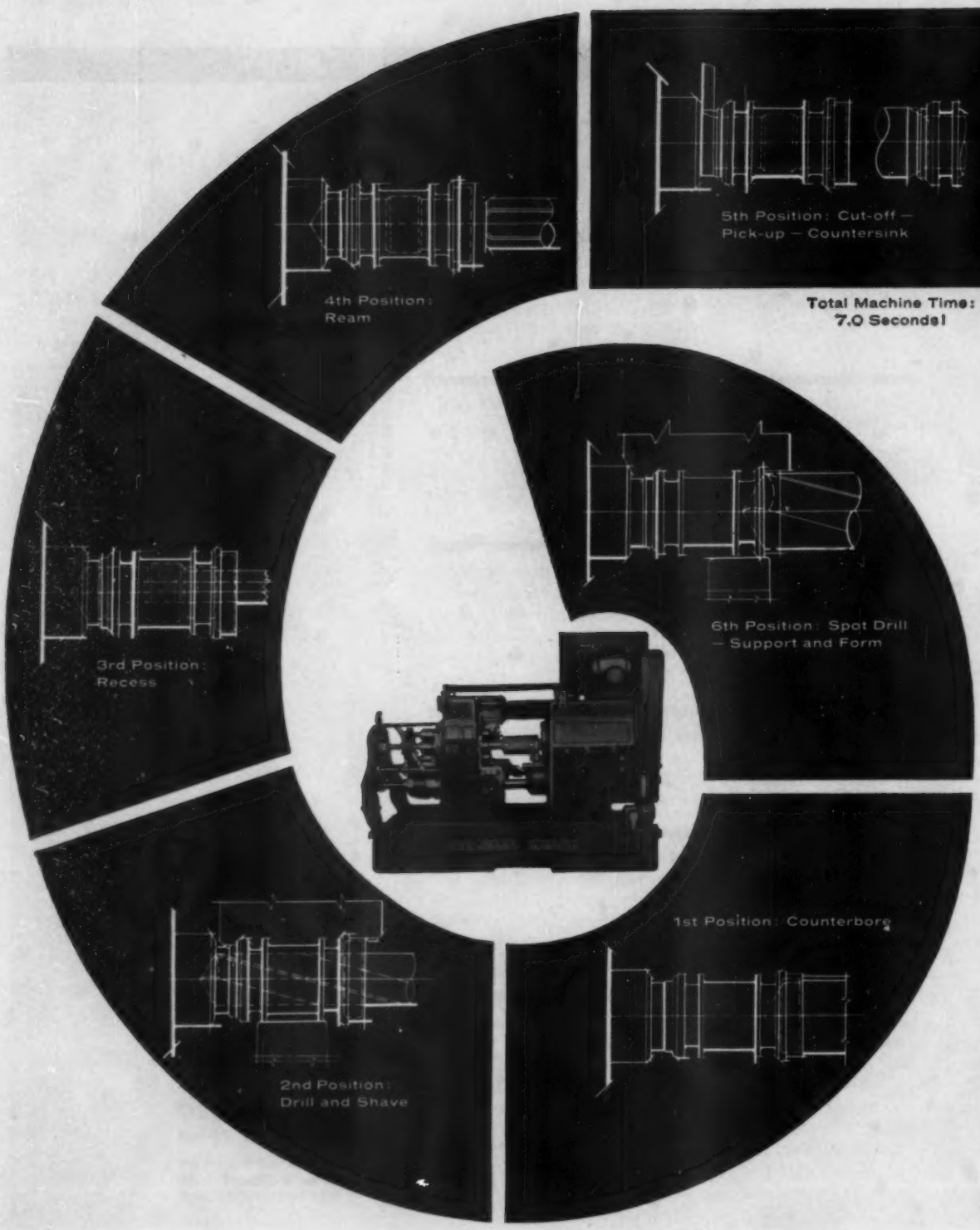
Material	C1144 steel
Workpiece length	11"
Involute Spline	.625 P.D., 21.1849/ 40 pitch, 12 tooth, 30° pressure angle, 25° right-hand helix angle, 1-13/16" long
Knurl	.633"-.638" diameter, .040" pitch, 49 tooth, 90° straight knurl, 3-3/4" long

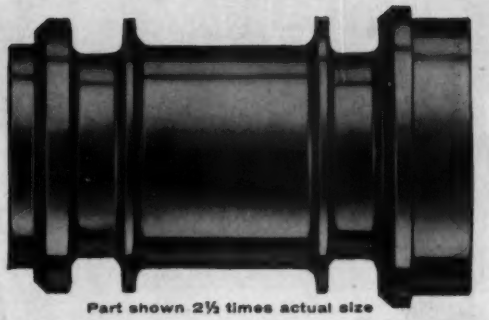
LANDIS Machine COMPANY

WAYNESBORO PENNSYLVANIA

The World's Largest Manufacturer of Threading Equipment

59BO


5th Position: Cut-off — Pick-up — Countersink
Total Machine Time: 7.0 Seconds!
4th Position: Ream
6th Position: Spot Drill — Support and Form
3rd Position: Recess
1st Position: Counterbore
2nd Position: Drill and Shave



Part shown 2½ times actual size

"EVEN WE WERE SURPRISED WHEN THE ACME-GRIDLEY DOUBLED OUR PRODUCTION

We'd refigured our set up for bushing blank production and were convinced that the Acme-Gridley would produce greater results than our current automatic machine set up. But, when we *doubled* production and wiped out a 7% reject rate to boot, we were amazed!"

Here at National Acme, we hear a lot of statements like this one made by Ness, Inc., up in Rochester, N. Y. They're one of the country's top product shops and tell us Acme-Gridleys have a lot to do with their success. Just about anybody who has to produce large amounts of an identical precision part will tell you the same thing.

The number of *different* jobs that can be set up on an Acme-Gridley amazes everyone. To give you some idea, we've described some 57 actual jobs in a new 64 page bulletin called "Circumferential Automation at Work". For your free copy, call, write or wire.

National Acme

The National Acme Company
171 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

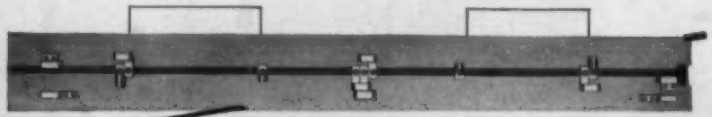
New Model 205 S-12
(Ship No. 2)

MORE PARTS FASTER with the NEW S-12 series

knee type milling machines

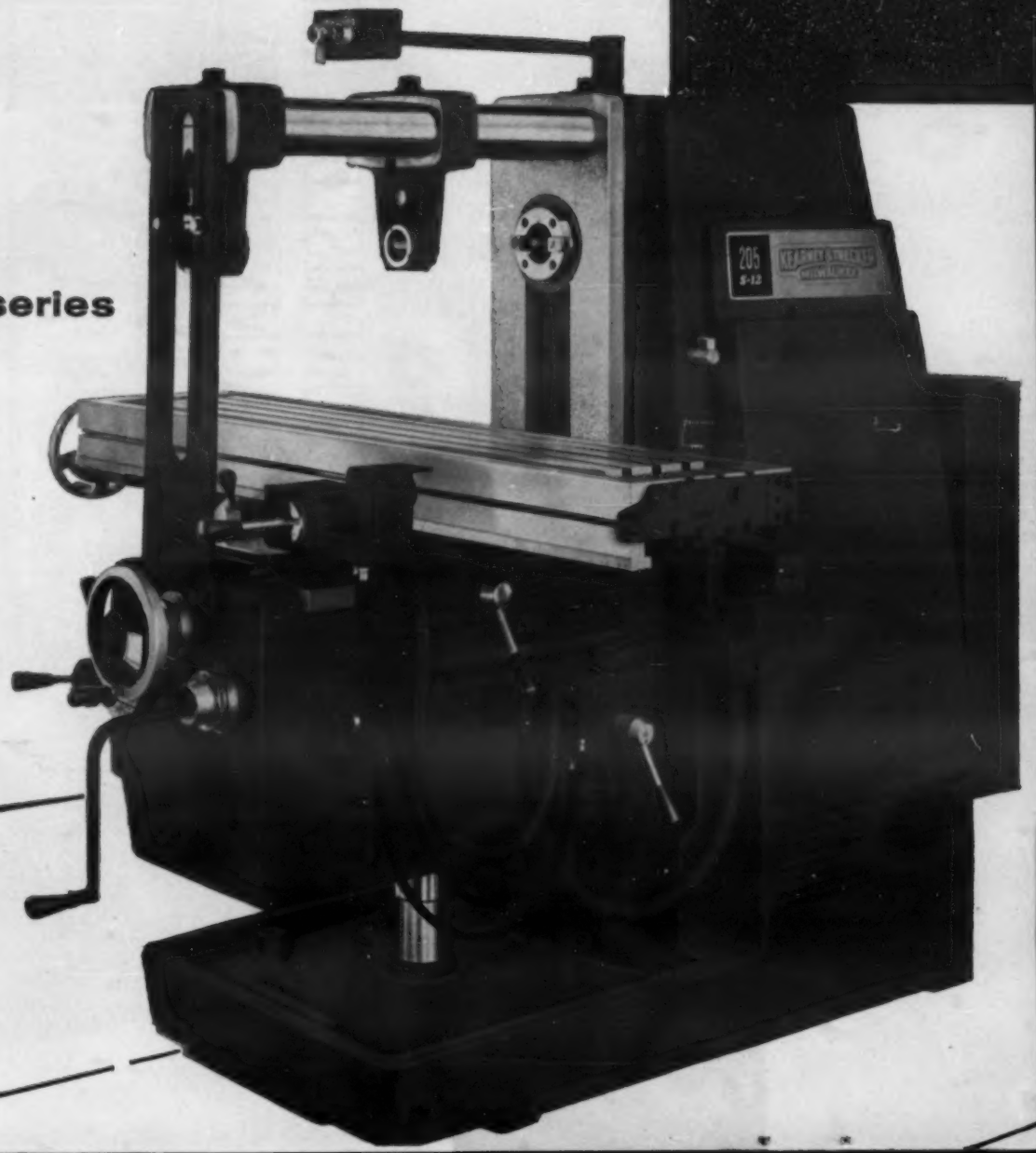
Unquestionably your first impression of the clean, functional styling of these all-new "*S-12's*" will be an immediate feeling of modern precision, strength, stability, and careful, thorough engineering. BUT — there's a lot more to these all-new "*S-12's*" than first meets the eye! There are time-saving, production-boosting features incorporated in this all-new "*S-12 Series*" that make it worthy of your most serious *Consideration and Comparison* if you have any thought of modernizing your plant facilities to increase productivity.

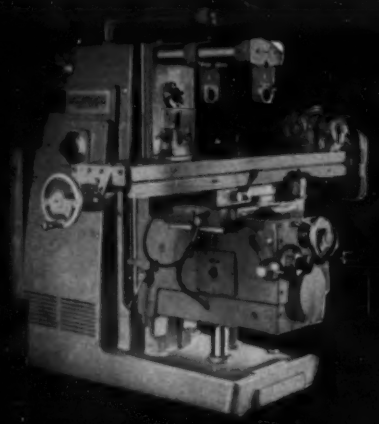
Here are but a few of the new "S-12 Series" features that can help you make more parts — faster.



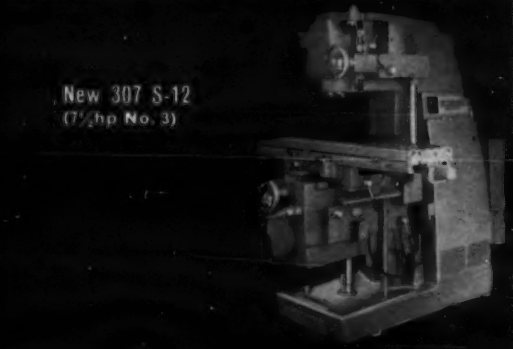
SIMPLIFIED TRIP DOGS...

COMPARE K&T's exclusive **AUTOCYCLE Control** for production milling with knee type flexibility and versatility . . . more parts faster with less effort, because idle time is automatically converted to cutting time. Four types of trip dogs — Feed, Rapid, Reverse, and Stop — mounted in a single slot on the front of the table, control a basic reciprocal automatic cycle. Automatic cycles can be to left and/or right for either conventional or climb milling . . . permit utilization of full table travel.

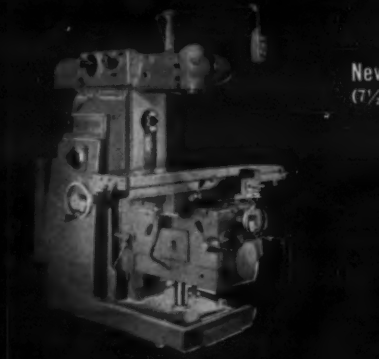




New 307 S-12
(7½hp No. 3)

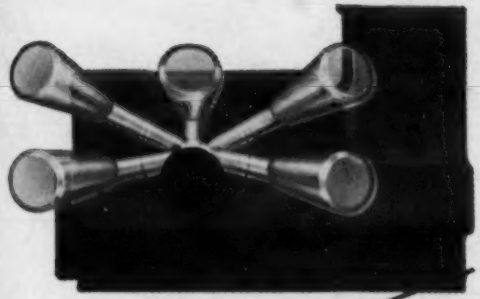


New 307 S-12
(7½hp No. 3)



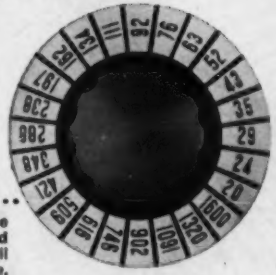
New 307 S-12
(7½hp No. 3)

Available on
TOOL LEASE
Minimum Capital Investment
Your Choice of 3 Plans



SINGLE LEVER CONTROL...
COMPARE this new concept in single-lever control, the **MONO-LEVER**, a Kearney & Trecker "First" in the industry. On all **AUTO-CYCLE "S-12's,"** this single, six-position lever controls table feed, rapid traverse, AND rapid traverse movements of saddle, knee, and vertical head . . . is used for both manual or **AUTOCYCLE** control with equal advantage.

POWER ASSIST FEED CHANGE...
COMPARE the speed and ease of the **S-12 Feed Rate Change** . . . a simple pull and turn with these large, easy-to-read Feed Range Dials through the shortest arc in either direction, and the **S-12** is set to the desired feed rate. Changes are locked in without over-ride or coasting — change gears are hydraulically shifted and held.



POWER ASSIST SPEED CHANGE...
COMPARE the ease of the **S-12 Speed Change.** Just a pull and turn of this large, easy-to-read dial through the shortest arc in either direction to select any of 24 speeds from 20 to 1600 RPM on the **205 S-12's.** 24 speeds, from 30 to 2400 RPM on the **307 S-12's.** Speed changes are locked in without over-ride or coasting. Shifting is smooth and quiet. Safety interlock prevents change being made during a cut.

AUTOMATIC BACKLASH ELIMINATOR...
COMPARE the **S-12's Self-adjusting Automatic Backlash Eliminator.** Makes climb milling just as easy as conventional milling. A mere twist of the wrist sets it for instant use in reciprocal milling cycles.

QUICK-SET DIALS...
COMPARE this **S-12** time-saver, **Rapid-Set Micrometer Dials.** Non-glare finish for easy reading . . . spring-loaded. Merely pull out and rotate to desired setting, and release for quick, positive-lock settings . . . graduated in .001" increments. Handwheels and handcranks do NOT spin during power feeds or rapid traverse.

This is but a brief look, a mere smattering of the outstanding features incorporated in these all-new *S-12 Series* machines. They're literally new from top to bottom, inside and out, for truly modern cost-saving, maintenance-saving, fast, accurate, profit-producing operation.

All we ask is that you Consider and Compare these all-new Kearney & Trecker S-12 Series Milling Machines. Discover for yourself that there are none newer . . . none finer . . . none better suited for increasing productivity.

To assist you, the facts for your *Consideration and Comparison* — Bulletin No. S-60, and RS-60 will be mailed promptly upon request.

Standard Machinery Division

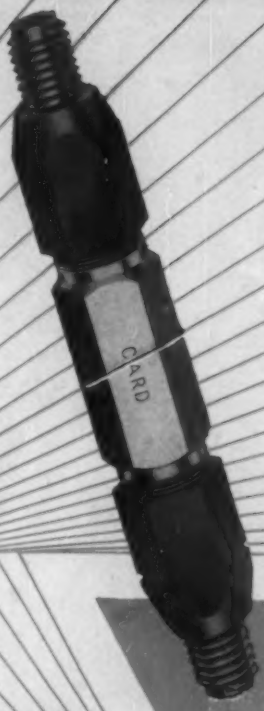
KEARNEY & TRECKER MILWAUKEE

KEARNEY & TRECKER CORP.

6800 W. NATIONAL AVE., MILWAUKEE 14, WIS.

(or phone GReenfield 6-8300... direct Distance Dialing Code No. 414)

CIRCLE 176 READER SERVICE CARD



CALCULATED TO CUT COSTS

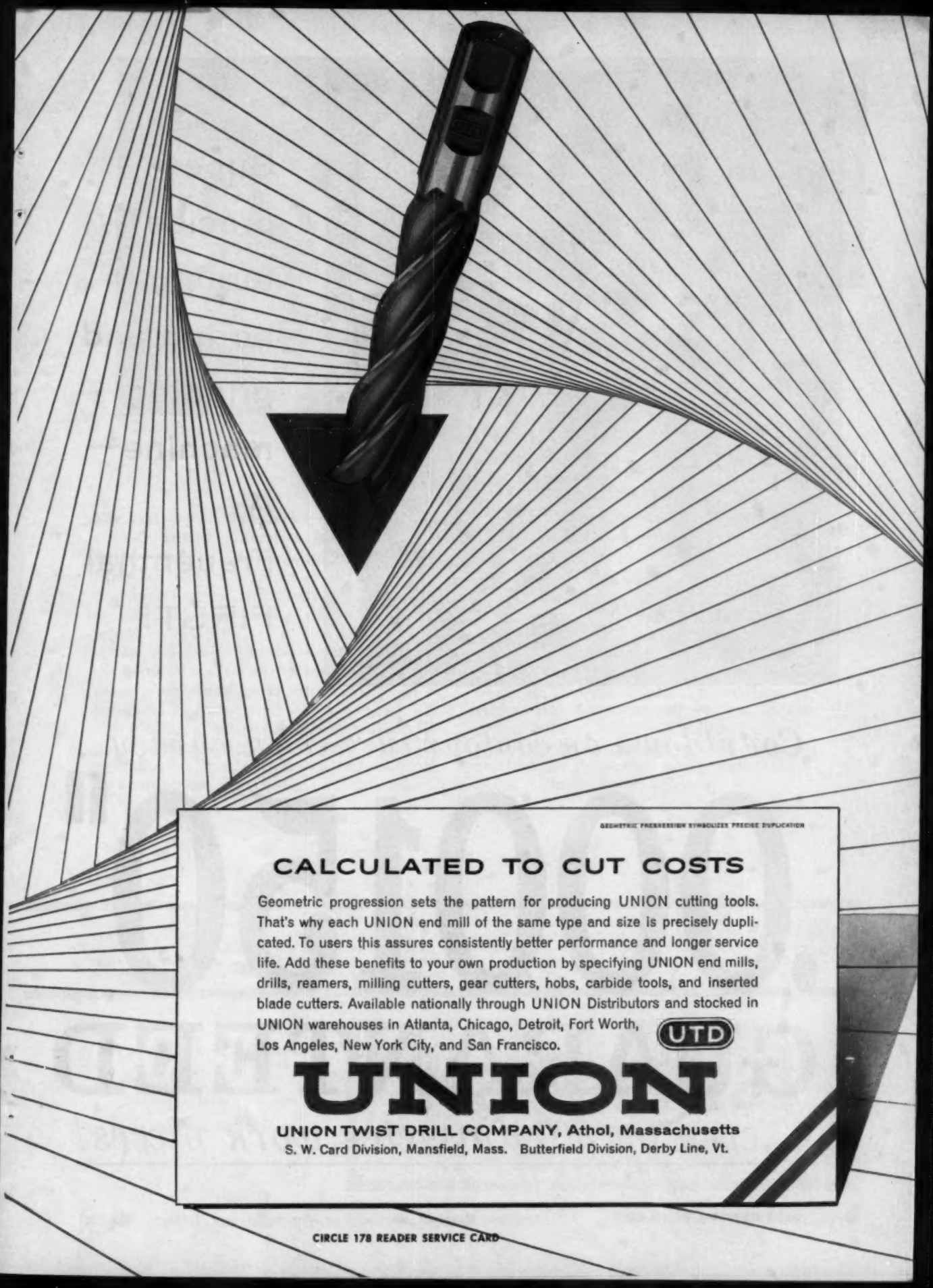
CARD gages, like forms in geometric progression are duplicated with consistent accuracy. Precise duplication like this can help you save production time and money. Get the gages you need from your CARD Distributor, who carries a full line of gages, taps, dies, and screw plates. And get expert advice on their selection and use from your CARD technical man. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

CARD

DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast

CIRCLE 177 READER SERVICE CARD



GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

Geometric progression sets the pattern for producing UNION cutting tools. That's why each UNION end mill of the same type and size is precisely duplicated. To users this assures consistently better performance and longer service life. Add these benefits to your own production by specifying UNION end mills, drills, reamers, milling cutters, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco.

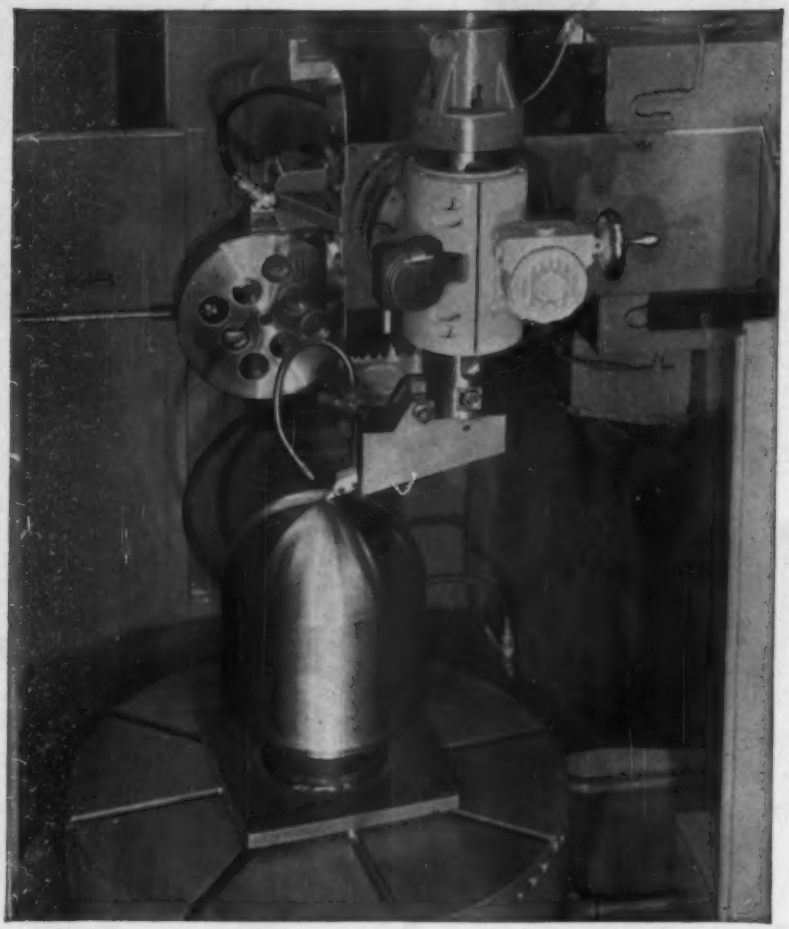
UTD

UNION

UNION TWIST DRILL COMPANY, Athol, Massachusetts

S. W. Card Division, Mansfield, Mass. Butterfield Division, Derby Line, Vt.

CIRCLE 178 READER SERVICE CARD



Super-precise turning, boring and grinding machine— A Frauenthal FIRST!

Countdown on contour turning accuracy...

.00150"

GUARANTEED

...even on 30" diameter work pieces!

The new Frauenthal electrohydraulic tracer control incorporates super-precise recording facilities. Recorded are the accuracy of the follower to the tracer template and the machine slides.

This versatile 900 Series machine has a 30″-diameter table with maximum swing of 36″. Maximum vertical slide travel — 32″; maximum vertical travel on manual turret slide — 3″.

The custom-built 900 Series achieves critical contour turning accuracies not available in similar machines. The precision-guaranteed 900 Series will hold a tolerance of ± .000150″ on contoured surfaces, with tolerances as close as ± 100 millionths possible on straight work pieces.

The 900 Series utilizes vertical design to eliminate the deflection normally encountered when unsupported parts are machined in a horizontal position.

Frauenthal's ultramodern electrohydraulic tracer system affords a new high degree of control reliability. Completely transistorized for compactness, it guides the vertical and horizontal travel simultaneously through 360° of motion. Any variation from true contour path is immediately indicated on a continuous recorder which also gives a permanent record of contour turning accuracy.

A numerical control for continuous path or point-to-point positioning is also available.

Enjoying unusual versatility, the new turning and boring unit anticipates machining needs far into the future. The machine will easily adapt to conventional grinding, turning, boring, milling, facing and polishing.

You can bring your most difficult machining problems to Frauenthal with complete confidence. Contact Frauenthal now.

Versatility of vertical machine design cuts floor-to-floor time • Two-axis tracer system holds stock removal constant per revolution regardless of stylus location on the contour • Cast work table with tee slots is ground flat to surface-plate accuracy to insure precise setup, measuring and installation of fixtures • Exceptionally efficient water-type heat exchanger and variable temperature control regulate the hydraulic system temperature within ± 1° to hold oil viscosity and maintain accurate tracing • Automatic force-feed lubrication • Unit can also be equipped for grinding.

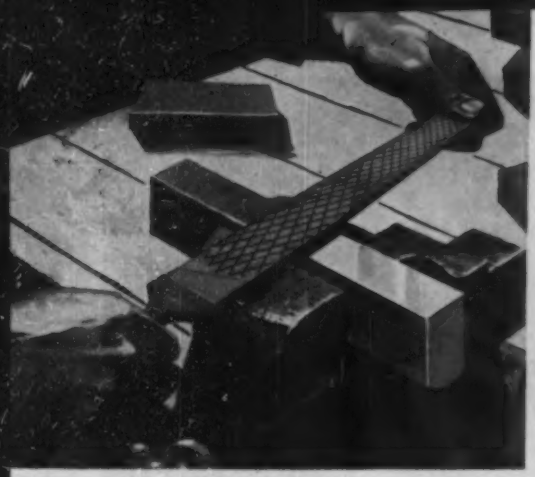
Designed and built in the U.S.A. You get American quality when you buy Frauenthal.

Frauenthal

DIVISION

THE KAYDON ENGINEERING CORP.

MUSKEGON, MICHIGAN, U.S.A.

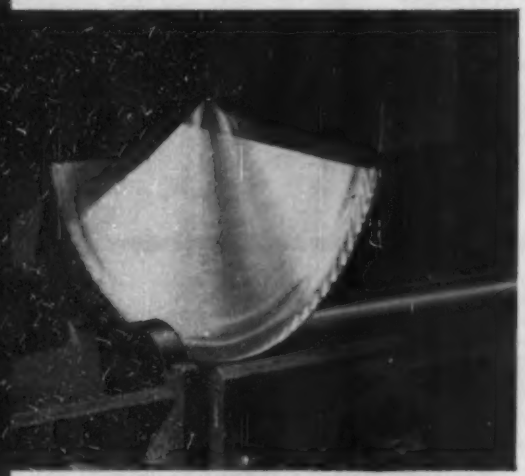


"RED TANG" FILES

For Faster, Easier Filing. Simonds "Red Tang" Files are sharper to start with, hog off more metal per stroke. More wear-resistant, too, they keep on cutting long after other files are dull and useless.

"RED END" HACKSAW BLADES

Up Your Cutoff Capacity. Simonds tough "Red End" Blades don't hack, but cut curled chips like the cutting tool on a lathe. Made of cross-rolled steel, they stay sharp longer, resist breakage, cut fast and straight — 3 types (hand and power) for all needs.



SIMONDS CIRCULAR SAWS

Tops for fast, straight cutting. Simonds Saws are designed and made to stay on the job longer — cut all types of metal — stretch your saw dollars.

SIMONDS MEANS SAVINGS WHATEVER YOU CUT

Up to three
with Simonds

CIRCLE 181 READER SERVICE CARD

times Longer Blade Life

SUPER High Speed Steel Band Saw

A proven fact! No matter what ferrous metal you're cutting, Simonds New SUPER High Speed Steel Band Saw Blade will give you *up to 3 times better performance* than any other high speed steel blade you're now using.

It's the biggest advance ever in metal cutting band saw blades! An entirely new concept — with new steel, new manufacturing methods, new heat treatment, new welding techniques, even new final inspection.

So startling are the performance records this new SUPER High Speed Steel blade is setting, we're offering it to you on a *Performance Guaranteed* basis.

Big savings are also being made with Simonds Standard High Speed Steel blades. Each in its proper application gives you money-saving features no competitive blades can match.

Call your local Simonds Distributor for prompt delivery or additional information.

INDUSTRIAL DISTRIBUTORS · THE RIGHT HAND OF PRODUCTION ·

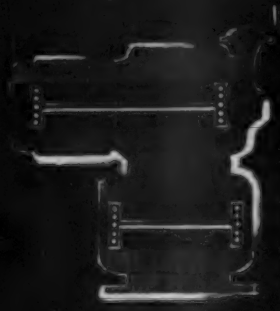
SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASSACHUSETTS

Buy through your local Simonds Distributor for — Local Stocks — Local Speed — Local Skill

Factory Branches in Union, N. J., Chicago, Shreveport, La., Los Angeles, San Francisco, Portland, Ore. • Canadian Factory in Granby, Que. • Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.; Heller Tool Co., Newcomerstown, Ohio; Simonds Abrasive Co., Philadelphia, Pa. and Arvida, Que., Can.

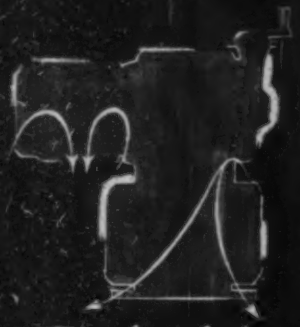
Field Versatility

Mounting feet, end brackets, control hand wheel, conduit box, and output shaft can be relocated in minutes without special tools for wall, floor or ceiling mounting. Components can be changed or controls can be added in the field to meet ever changing conditions of operation.



Four-Bearing Design

This important design feature eliminates the problems of overhung discs. It equalizes distribution of belt loading — keeps bearings, shafts, discs and belt permanently aligned — improves performance — and extends bearing life.



Dual-Ventilation System

The motor and the belt housing of the ALLSPEDE DRIVE are individually ventilated. Motor ventilating air is not exhausted into the belt housing — belts run cooler for longer life. Service factor and operating life of all components are higher because of lower operating temperatures.

Trouble-Free Remote Control

Electrical remote control can be provided by an enclosed speed adjusting motor, mounted on the belt changing mechanism. This torque motor can be stalled without overheating, eliminating the need for troublesome limit switches.

Long Belt Life

Single-cog belts with extra contact area provide more efficient transmission of power and longer belt life. Dual ventilation, precision-machined discs, equalized loading, and automatic belt tension aid in extending belt life.

Fast Belt Changing

Belt changing is fast and easy — without requiring special tools. You remove only one bearing bracket and the speed adjusting mechanism to make fast changes without affecting permanent alignment of discs or belts.

Remote Speed Indication

A tachometer generator mounted on the output shaft operates an indicator that can be mounted at a remote location. Disassembly of the tachometer is not required when making belt changes.

Another new product from Louis Allis

Four of the many variations of mounting available with the ALLISPEDE DRIVE.

Let's look at the features of the ALLISPEDE DRIVE*

New Louis Allis Drive offers accurate control – maximum belt life – long-run economy – low-cost versatility – ease of installation

After checking the many superior features of this drive, you will prefer the Allispede every time. The illustrations at the left demonstrate the many advantages of design and construction available in this drive.

The Allispede Drive gives you high efficiency and close regulation. Belt tension adjusts automatically — and belt changes are easy and fast. The modern design eliminates overhung discs—maintains belt and disc alignment — results in longer belt life — provides the ultimate in field versatility.

Check the accompanying features — *now!* A phone call to your local Louis Allis District Office will bring a skilled Louis Allis Field Engineer. He will gladly study your drive problem and offer Application Engineering assistance. Or write to Louis Allis Company, 452 East Stewart Street, Milwaukee 1, Wisconsin for a copy of Bulletin 3600.

*ALLISPEDE is a trademark of The Louis Allis Company.

The Complete Line–

Whatever your mechanical drive application requirements, there's an ALLISPEDE DRIVE to match it exactly. Sizes up to 30 HP, output speeds from 1 to 10,000 RPM, and speed ranges up to 8:1. Motors can be open, drip-proof, enclosed, or explosion-proof; with ventilated or enclosed belt housings, suitable for foot, P-base, C- or D-flange mounting on your machine. Available with parallel shaft, or right-angle, integral gear reducers, special shaft extensions, integral magnetic brakes, electrical or mechanical remote control, and other modifications as required to meet the specifications of your application.

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

LOUIS ALLIS

CIRCLE 184 READER SERVICE CARD

NEW GIANT AT WORK on Double Diamond Gears

This huge, continuous, carburizing, hardening and draw furnace now permits even greater instrument control in heat treating DOUBLE DIAMONDS for maximum wear resistance and load-carrying capacity. So far as we can discover no more efficient furnace could be installed to achieve the quality characteristics our gear customers have come to expect.

At your request, our gear engineers would be pleased to describe this process in greater detail and to explain, as well, what our recently expanded facilities can mean in terms of this pledge: "DOUBLE DIAMOND Gears offer the advantages of lower installed cost and economical and dependable service on the job . . . gears that do credit to your product and reputation."

EATON

AUTOMOTIVE GEAR DIVISION
MANUFACTURING COMPANY
RICHMOND, INDIANA

GEARS FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

CIRCLE 185 READER SERVICE CARD

SINGER* NUMERICAL CONTROL

The Singer Numerical Control System represents the most direct approach to point-to-point positioning yet conceived. It offers simplicity, reliability and economy, reducing costs of maintenance, labor and downtime.

A major feature of Singer automation is modular design. This makes it possible to assemble basic units in a variety of control systems.

AUTOMATIC POSITIONING SYSTEM

For example, because of the simplicity of Singer modular design, an Automatic Positioning System can be furnished immediately as standard for use on a drilling machine to drive and position the work table and saddle motion.

All that is required is a motor drive assembly (A) and a position indicator control (B) on each axis. This system will then operate with standard end measures.

At any future time, tape control can easily be added to provide a complete Singer Numerical Control System, as shown below with a Fosdick 5BM Sensitive Drill Press.

(A)
(B)
Diehl
POINT-TO-POINT POSITIONING
AN INVITATION
You are cordially invited to visit the Singer Numerical Control demonstration room at the Diehl Manufacturing Company
Diehl
DIEHL MANUFACTURING COMPANY
SUBSIDIARY OF THE SINGER MANUFACTURING COMPANY
Finderne Plant, Somerville, New Jersey
Telephone: Randolph 5-2200
*A Trademark of THE SINGER MANUFACTURING COMPANY
†A Trademark of THE DIEHL MANUFACTURING COMPANY

Measure the cost of the holes . . .

not the cost of the tools

When you are faced with the problem of cutting the costs of your manufacturing operations, your best solution is to rely on *quality* tooling.

The small savings you may make on the initial purchase price of cutting tools can't possibly offset the extra dollars you lose in *higher cost per hole.*

You'll always save money with quality tools . . . the kind of tools that give you more holes per grind, more holes per tool, less down-time on your machines, faster production and fewer parts rejected.

This adds up to *lower cost per hole.*

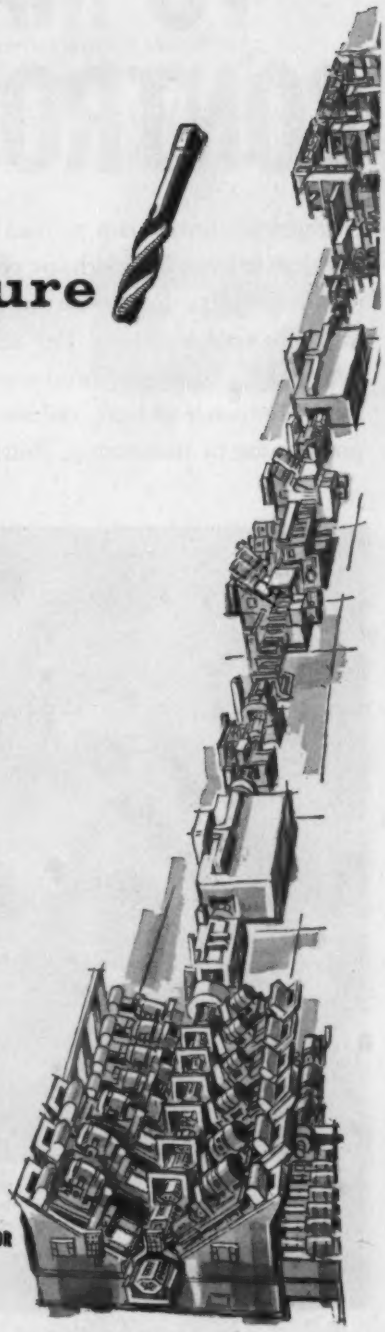
CLEVELAND Tools are designed and manufactured to highest quality standards. In every set-up, on any type of machine, they will help you reduce your costs. This has been proved time and time again in customers' plants.

Moreover, CLEVELAND Quality Tools are sold exclusively through Industrial Supply Distributors, who carry complete stocks for prompt delivery. The steady flow of volume orders from hundreds of distributors enables us to produce the full line of ◈ Quality Tools in large, economical quantities—with resultant advantages to you.

THE CLEVELAND TWIST DRILL CO.
Cleveland 1, Ohio

QUALITY CUTTING TOOLS • BEST SERVICE THROUGH YOUR LOCAL DISTRIBUTOR

How to prevent cutting tool failure



All of your equipment, from a $1,400 tapping machine to a $1,400,000 automobile engine block transfer machine, deserves *quality tooling*.

Tool failure, which often is the result of buying taps on the basis of price alone, causes excessive "down time", smaller output per hour, and higher cost per hole or per piece.

Quality taps, on the other hand, reduce tool failure to a minimum. They are your best assurance of efficient and continuous operation, high output, and lowest cost.

It just doesn't make sense to save a few pennies on the initial price of cutting tools. Lower priced taps are almost always the most expensive in the long run —and often for short runs, too!

Telephone your Industrial Supply Distributor for BAY STATE Quality Taps. He can give you prompt delivery from stock.

BAY STATE TAP & DIE CO.
Mansfield, Mass.
Subsidiary of The Cleveland Twist Drill Co.

QUALITY CUTTING TOOLS • BEST SERVICE THROUGH YOUR LOCAL DISTRIBUTOR

BENDIX PROVIDES SYSTEMS EXPERIENCE TO MAKE NUMERICAL CONTROL WORK FOR YOU

Numerical control is a proved concept in metalworking. It has demonstrated its worth in scores of applications, but perhaps your manufacturing problems are different. Why not enlist the services of Bendix—long-time supplier of practical, reliable numerical control systems to most major machine tool builders. Let us be your prime source of information and assistance when the demand for increased productivity indicates a need for more modern equipment that will reduce scrap, reduce lead time, reduce inventory costs, and reduce tooling costs. Whether it's contouring, positioning or measuring, Bendix has the solution to your particular problem.

Versatility of Bendix DynaPath contouring controls is illustrated by this machine tool which will grind, turn or mill in two or three axes, with 0.0001-inch tool path accuracy.

YOU NEED BENDIX SYSTEMS EXPERIENCE when you consider numerical control for your application! Bendix offers:

1 JUSTIFICATION STUDIES—what can numerical control do for you?

2 SYSTEM ENGINEERING—applying the right control to the right machine tool.

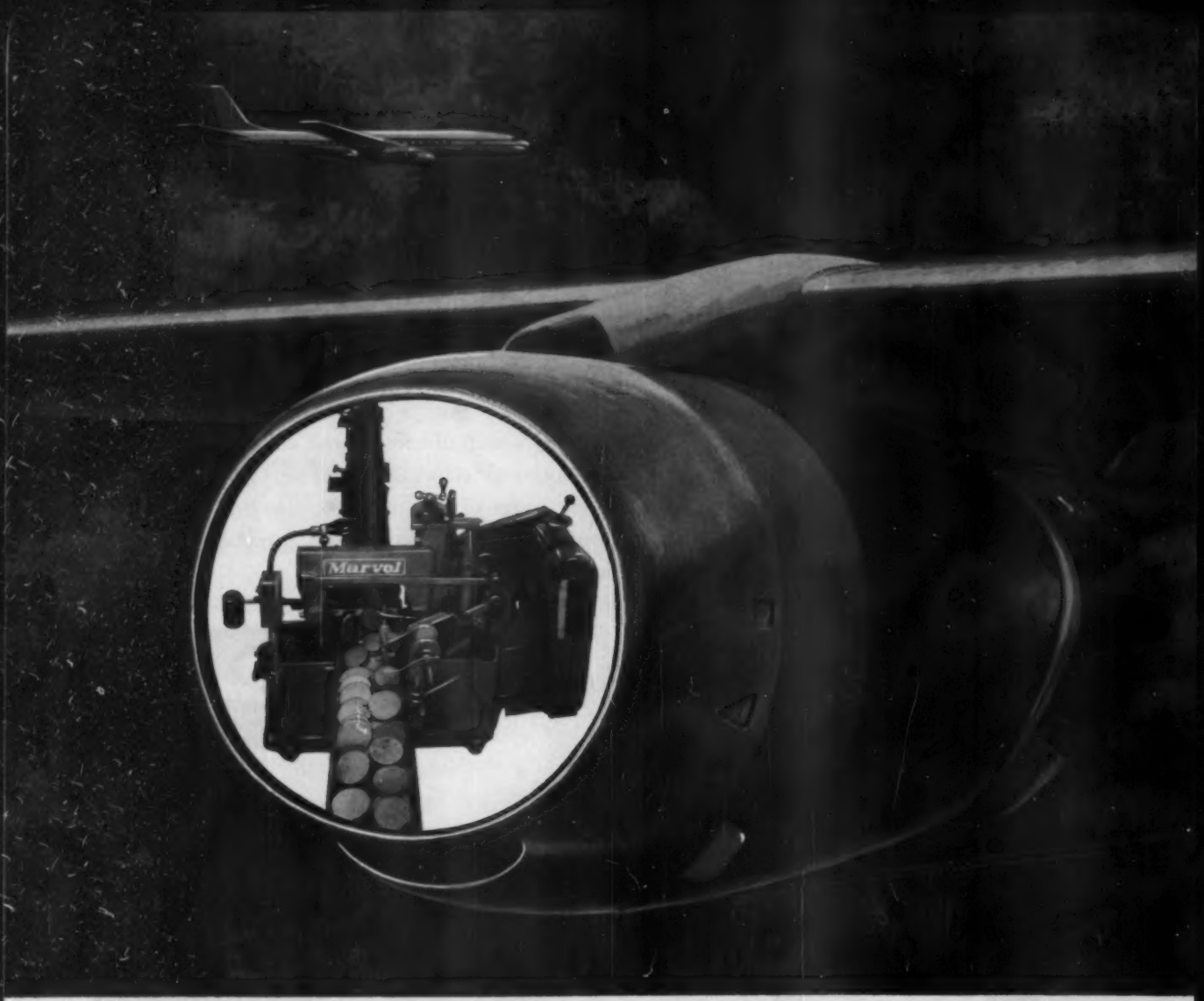
3 TRAINING AND SERVICE—for maximum machine utilization rates.

The unique Bendix Systems Experience is backed up by a staff of experienced electronic, mechanical and hydraulic engineers, mathematicians, instructors, technicians, and parts planners. Our contract machining and tape-making facilities offer years of accumulated case histories on all manner of applications *and* a chance to check out *your* problems in actual practice. Why not write today for more information on Bendix Systems Experience.

Industrial Controls Section
21820 Wyoming Ave., Detroit 37, Michigan

THE Bendix CORPORATION

Bendix
SYSTEMS EXPERIENCE
For tool room work, Bendix DynaPoint positioning systems can hold 0.0001-inch tolerances on this jig borer.
With Ferranti numerical control, this turret drill will do the work of several conventional machines, and reduce scrap.



TOO SLOW ?

Emphatically not! . . . ask any visitor to the 1960 Machine Tool Exposition who watched a Marvel No. 6 Hack Saw Machine cut-off 3¼" diameter 1018 steel in 27 seconds! This Saw, costing less than $3000, was actually cutting at the rate of 18 square inches per minute!

We made the above demonstration merely to "match" what we believe to be the impractical demonstrations of some of our competitors. OUR visitors were warned that continuous cutting at this speed is economically impractical if maximum blade life and accuracy (after the first 20 cuts) are desired. They were told that the material could be cut day in and day out, at the rate of 8 square inches per minute with tool cost of approximately 1 cent per cut.

Our point? Marvel No. 6 and No. 9 Series Heavy Duty Ball Bearing Hack Saw Machines, as we build them today, have speed to spare. And they offer the most accurate, economical cut-off at the lowest initial investment.

Ask your Marvel Dealer to arrange a sawing demonstration—on your own work—if you wish. Because we have consistently built both Hack Saws and Band Saws for more than 40 years, you will get an unbiased recommendation.

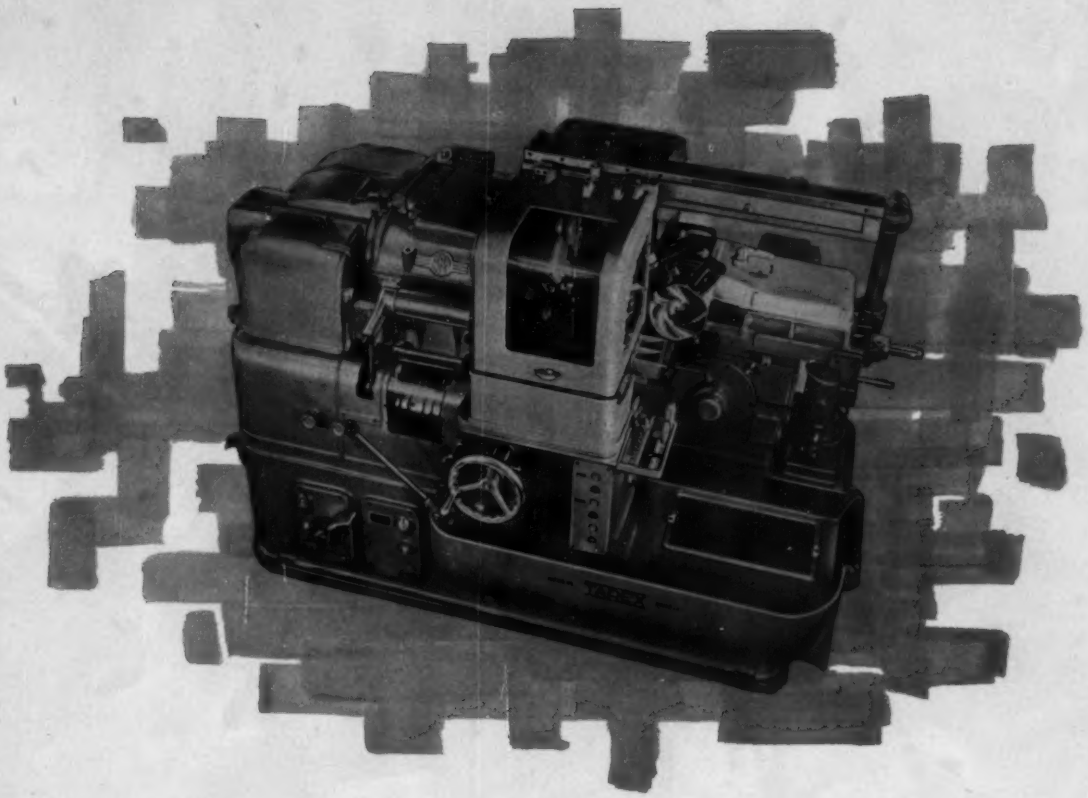
Catalog C60 illustrates and describes the complete line of Marvel Sawing Machines. Write for your copy.

MARVEL *Metal Cutting* **SAWS**

BETTER MACHINES
BETTER BLADES

ARMSTRONG-BLUM MANUFACTURING CO. • 5700 Bloomingdale Avenue • Chicago 39, Illinois

S-1318



Why The TAREX *Can Do Things No Other Machine Can Do*

Because the TAREX is a Swiss single spindle automatic, designed and engineered for the production capacity of a **turret lathe with**

added capacity—for chuck and bar work with the same universal spindle

added precision—short spindle construction, chainless direct drive

added versatility—ingenuously designed exclusive Tarex extra capacity attachments

greater production—much higher rpm than comparable machines

better finishing—sturdier construction

and many other plusses you should investigate.

There is a TAREX for almost every purpose from ¾" to 3½" of bar and 8" dia. of chuck work.

Ask for a demonstration

Prompt TAREX service available—complete stock of spare parts. Engineered for production, serviced with Swiss thoroughness.

Submit your machining problem with blueprints for analysis and our recommendations.

Exclusive U. S. Representatives

THE ARTHUR LOEFFEL COMPANY, INC.

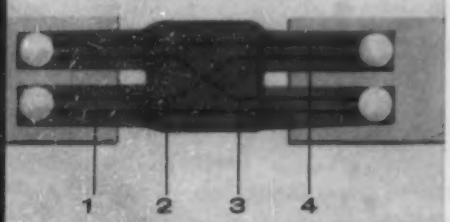
MERRICK, N.Y. • TEL. FREEPORT 9-8600 Offices in Chicago and Los Angeles

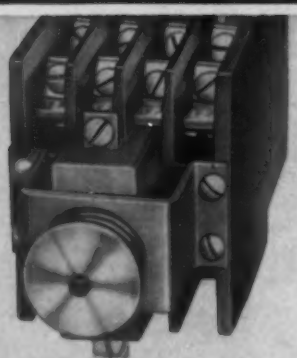
◄ CIRCLE 191 READER SERVICE CARD

CIRCLE 192 READER SERVICE CARD

Another Cutler-Hammer first! Up to 24 poles in an area less than the size of a dollar bill.

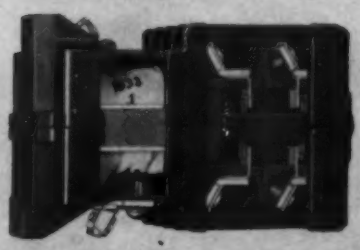
New contact reliability. Parallel bifurcated contacts, which allow four current paths instead of one, provide infinitely greater circuit reliability . . . liberally designed so any current path carries full relay rating.





At last! "Mechanical memory" latch as reliable as the relay itself! No adjustment ever needed. Add latch at any time.

New simplified design! Cutaway view shows basic simplicity. Coil vacuum impregnated to resist damage from humidity, vibration, electrical stress. Terminals can be screw or spade type.



Space savingest relay you've ever seen: New Cutler-Hammer "Compact 300"

Versatile 300 V. control relay is so reliable it's permanently sealed!

Here is the best answer yet to the need for an extremely reliable, small-size 300 V, 6 amp., industrial relay — the new "Compact 300" from Cutler-Hammer.

Every detail known that affects relay reliability has been improved in the "Compact 300." Bifurcated contacts which make possible *four* current paths rather than one, add millions of operations to the "Compact 300's" electrical reliability.

In fact, we're so confident of its electromechanical reliability, we permanently enclose the "Compact 300." And, if it should be damaged by a fault current, you throw it away and replace it with a new one. Its low price makes this an economical, practical maintenance procedure.

Now think of the space you can save with the "Compact 300." It controls up to eight circuits in panel space only 2″ wide by 2¾″ high. 2, 3, 4, 6 and 8 poles with any combination of N.O. or N.C. contacts are available, of course.

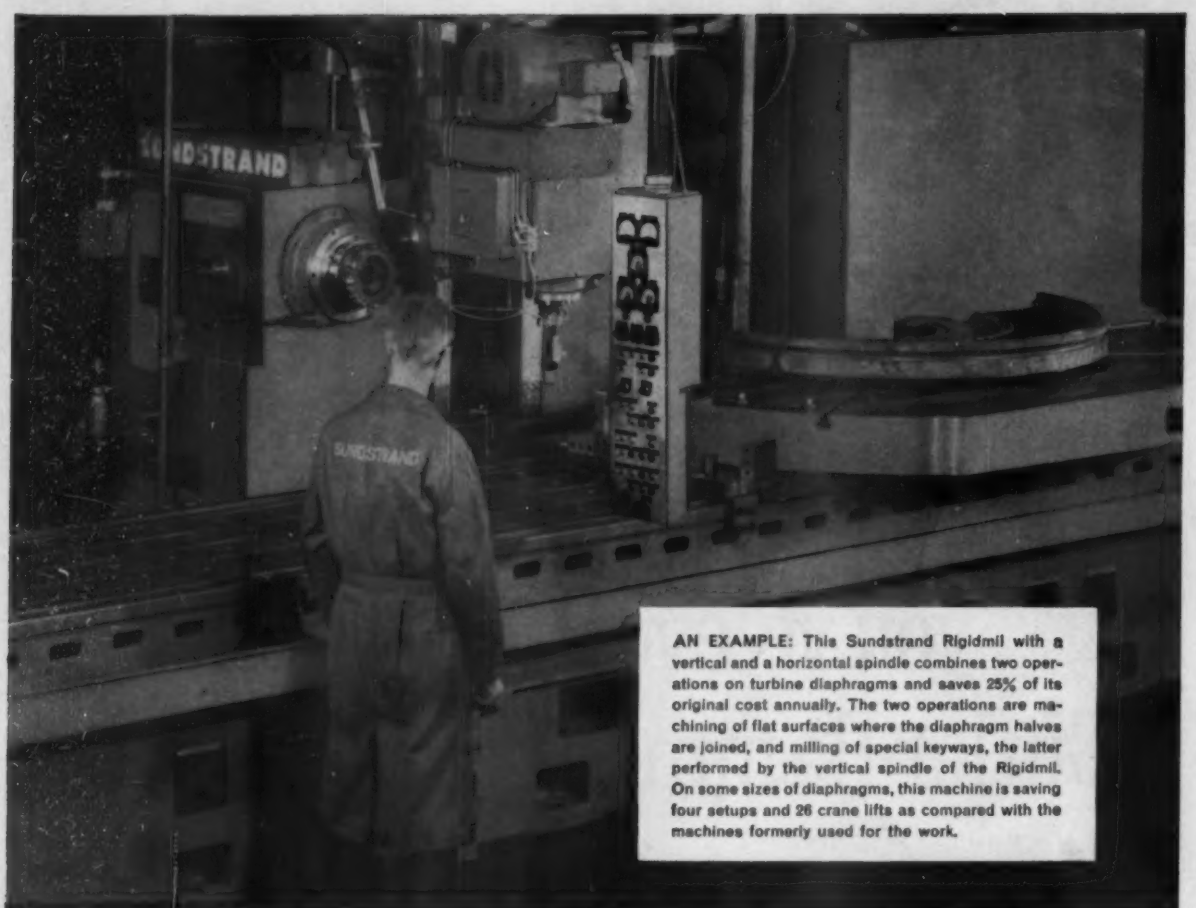
At any time, you can add "mechanical memory" latch with a life equal to the life of the relay. No adjustments are ever necessary. Contact your Cutler-Hammer distributor for details on the "Compact 300" or send for Pub. LO-79-C239.

What's new at Cutler-Hammer? New, better products, like the 300 V. relay are coming steadily from our new, expanded plant facilities. We're ready now to help you take care of the great industrial growth of the future. If you are planning ahead and need electrical control assistance, contact the nearest Cutler-Hammer sales office.

WHAT'S NEW? ASK...

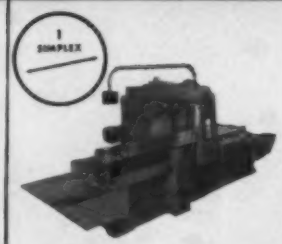
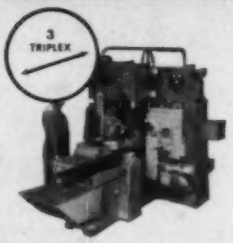
CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.



AN EXAMPLE: This Sundstrand Rigidmil with a vertical and a horizontal spindle combines two operations on turbine diaphragms and saves 25% of its original cost annually. The two operations are machining of flat surfaces where the diaphragm halves are joined, and milling of special keyways, the latter performed by the vertical spindle of the Rigidmil. On some sizes of diaphragms, this machine is saving four setups and 26 crane lifts as compared with the machines formerly used for the work.

custom milling machines *from* standard components

	1 SIMPLEX 	2 DUPLEX	3 TRIPLEX 
HEADS	3 to 100 hp | HORIZONTAL or VERTICAL	3 to 100 hp | HORIZONTAL or VERTICAL	3 to 75 hp | HORIZONTAL and VERTICAL
TABLES Width"	10½ to 96"	10½" to 38"	10½" to 38"
TABLES Feed Stroke"	18" to 216"	18" to 216"	18" to 216"
COLUMNS	FIXED OR CROSS TRAVEL	FIXED OR CROSS TRAVEL	FIXED OR CROSS TRAVEL
CONTROLS	PENDANT, TRACER OR TAPE	PENDANT, TRACER OR TAPE	PENDANT

Sundstrand offers you "Engineered Milling Production" with a standard machine line

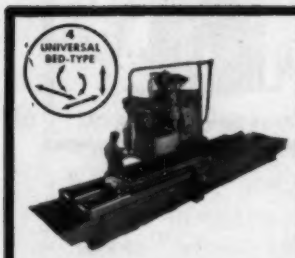
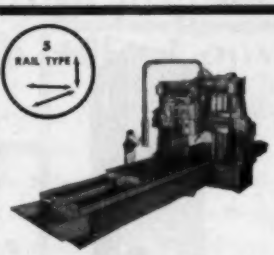
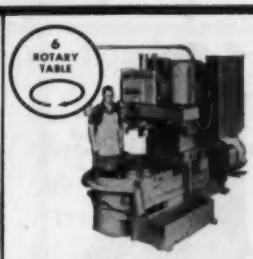
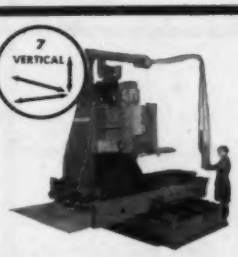
Unit construction provides almost unlimited arrangements, "custom-built" to meet your specific needs

The Sundstrand "Engineered Production" approach to your milling requirements assures you maximum productivity per dollar of machine investment. Sundstrand application engineers evaluate your production and then recommend a machine that will fit your requirements as if it were specially built for the job. This is possible because of the exceptionally wide range of Rigidmil sizes, types, and unit combinations available, as indicated in the table below.

For example, Sundstrand catalogs more than 138 standard Simplex and Duplex machines, plus a wide range of variations. Attachments such as vertical feed to horizontal heads, power feed to quills, automatic index bases, etc., provide additional cycle combinations.

The heads, columns, and tables on C-model Rigidmils are self-contained units, permitting interchangeability through several sizes. There is no need to compromise when you need a machine that isn't quite a standard model, nor do you have to buy more machine than you need. Adding the next size head or table can give you a custom-built installation at minimum cost. And you get extra protection against obsolescence because if your work requirements change, you can modify the machine by changing the head.

To determine how much the right Sundstrand milling machine can save you, send for Bulletin No. 124 and ask about a Sundstrand "Engineered Production" analysis of your production.

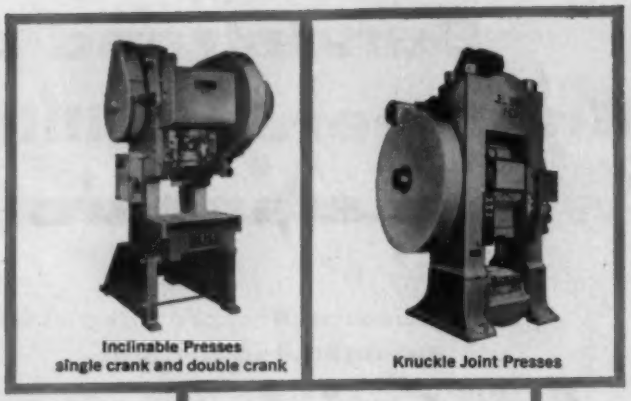
4 UNIVERSAL BED-TYPE	5 RAIL TYPE	6 ROTARY TABLE	7 VERTICAL
			
20 and 50 hp — ALL ANGLE and HORIZONTAL	25 to 50 hp — VERTICAL	25 hp — VERTICAL	50 hp — VERTICAL
24" to 38" 48" to 216"	24" to 60" 48" to 216"	Dia. 36", 48"	30" 96"
CROSS TRAVEL	FIXED	FIXED OR CROSS TRAVEL	FIXED
PENDANT, TRACER OR TAPE	PENDANT, TRACER OR TAPE	PENDANT, TRACER OR TAPE	PENDANT, TRACER OR TAPE

SUNDSTRAND

SUNDSTRAND MACHINE TOOL

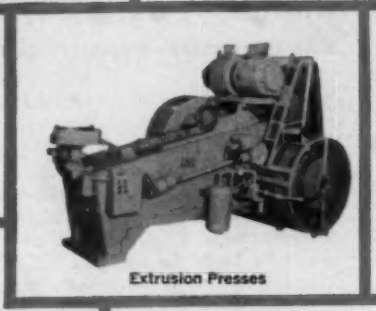
BELVIDERE, ILLINOIS • DIVISION OF SUNDSTRAND CORPORATION

Why do more people buy BLISS presses than any other make?



Inclinable Presses
single crank and double crank

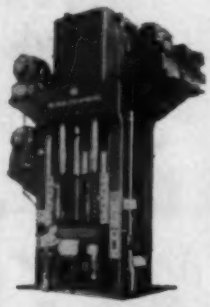
Knuckle Joint Presses



Extrusion Presses

Eccentric Presses

Rolling Bolster Presses



Hydro-Dynamic Presses

High Production Presses

Toggle Drawing Presses

(they do, and have for a long, long time)

No matter what kind of press suits a particular job best, Bliss can supply it.

And Bliss engineers' many years of experience is a valuable plus when it comes to recommending the right press. Straightside, inclinable, high-production, toggle, overdrive, underdrive, hydraulic—Bliss builds them all; grinds no axe for any one type.

But above these advantages . . . above Bliss engineering counsel and the vast Bliss parts and service organization that blankets the country . . . is the century-old Bliss tradition of quality and reliability.

"Bliss is more than a name . . . it's a guarantee" is more than a combination of nice-sounding words. It's a simple statement of fact.

BLISS
SINCE 1859

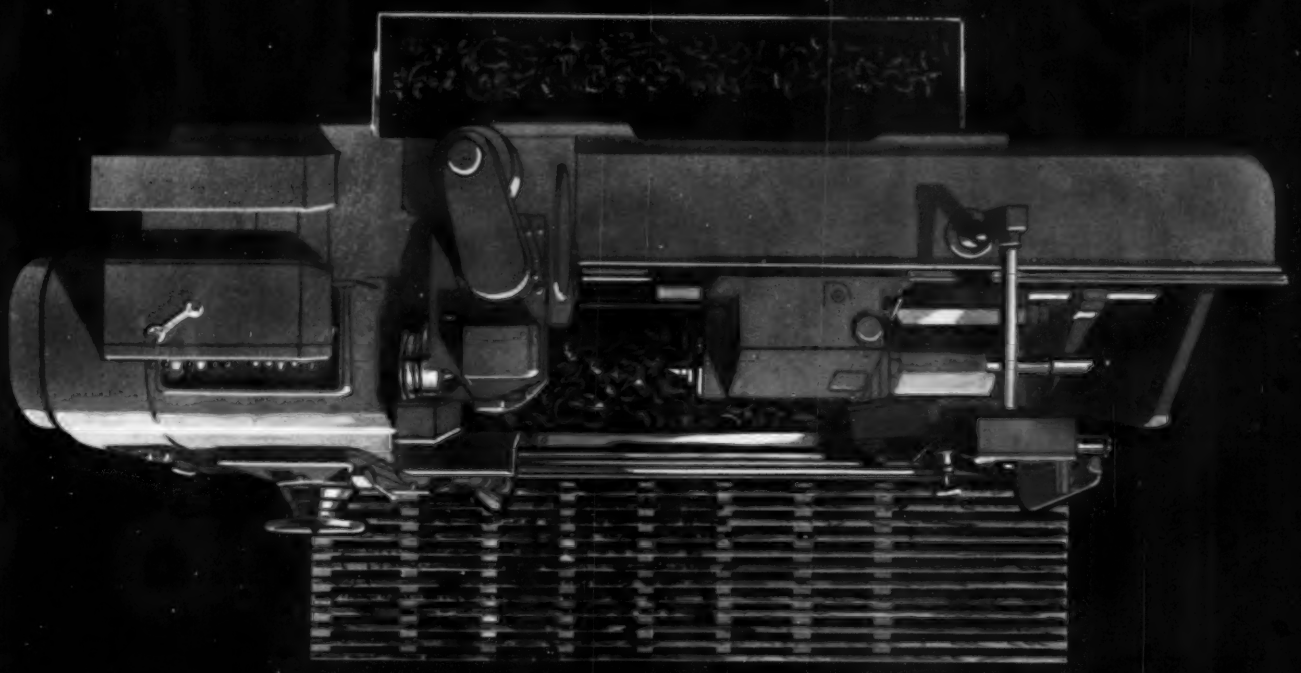
E. W. BLISS COMPANY · **Hastings, Michigan**

BLISS is more than a name—it's a guarantee

PRESSES • **ROLLING MILLS** • **ROLLS** • **DIE SETS** • **CONTAINER MACHINERY** • **CONTRACT MFG.** • **PUBLIC SAFETY**

CIRCLE 197 READER SERVICE CARD

CIRCLE 198 READER SERVICE CARD ►



You can turn a profit on a New Britain +GF+ Copying Lathe

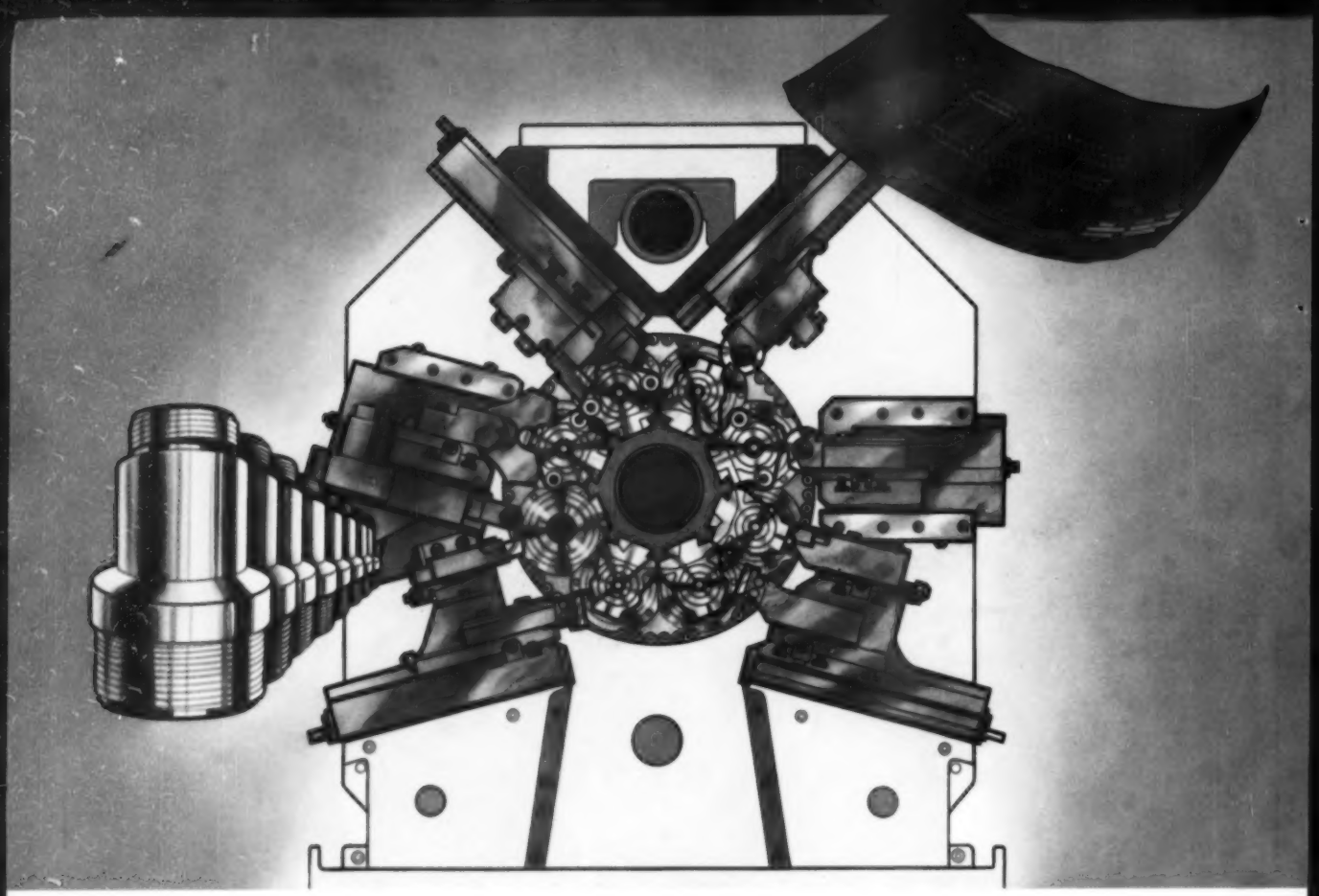
Here's a birdseye view of a New Britain **+GF+** Copying Lathe. It shows some important differences between this machine and conventional lathes with copying attachments. The point here is this—*the most effective use of the single-tool copy-turning principle can be made only with a machine designed from the ground up for this type of work.* The New Britain **+GF+** is just such a machine. Notice the chip pan. It's big (it has to be) and located for easy removal of chips from the back of the machine. The design of the work area allows for unobstructed free-fall of chips out of the way and into the pan.

The New Britain **+GF+** is massive and rugged, with plenty of power—up to 40 h.p., if you need it. It's simple to operate, quick to set up and change over. The single-point tool can be changed in one minute and it out-produces gang tooling setups in the bargain. Turning is controlled by either a template or a prototype. External and internal copying are accomplished in one set-up with special tooling.

The possibilities for short or long run chucked and between centers work on the **+GF+** are wide and varied. Because the work is produced with good surface finish and dimensional accuracy, grinding can be reduced and, in some instances, eliminated. Large diameters are broken down economically by successive parallel cuts, automatically if desired, with optional two-cut or multi-cut recycling.

You've got to see one of these machines in action to fully understand the kind and quantity of work they are capable of producing. Contact your New Britain Representative for demonstration arrangements or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division - New Britain, Connecticut



Unlimited tooling combinations with New Britain Bar Machines

Nothing can out-date your operation quicker than better machines in the hands of a competitor. In the race to keep ahead on quality, price and delivery, nothing can put you out front faster than machines capable of consistently producing the highest quantity of finished pieces at the lowest possible cost. New Britain's new series of bar machines represents in every way the most advanced bar-turning units available. Each of the four-, six- and eight-spindle models has been redesigned, adding new features and improving older ones. Unlimited cross slide and end-working tool combinations, extremely fast operation (even on stainless) and a variety of models and features to choose from add up to some good reasons for incorporating New Britains into your replacement or production expansion plans.

The eight-spindle model is the largest, most modern eight-spindle bar machine available. It has a stock capacity of up to 2⅝" and provides six independently-operated cross slides. As with all New Britain bar machines, the operations of the cross slides and end-working tool slide are disc-cam controlled for positive actuation, close tolerance machining and easy, rapid change-overs.

This is only a very small part of a story that is bound to interest you. The whole story and its significance in terms of your profits is available from your New Britain Representative. If you prefer, contact us directly at The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division - New Britain, Connecticut

POSITIVE DUPLICATION—EVERY TIME!

Just as you see these CINCINNATI Centerless Grinding Wheels duplicated with exact fidelity in these mirrors, you can be absolutely sure of Positive Duplication with *all* CINCINNATI (PD)° GRINDING WHEELS.

THREE DOZEN GOOD REASONS

Cincinnati is able to supply you with wheels of uniform excellence, because of its unique (PD) manufacturing process. This involves 36 separate and unvarying quality controls right from grain mix to final inspection.

For example, the six steps to grain uniformity are these: Grain size verified with screens . . . Grain cleanliness . . . Freedom of foreign matter . . . Color . . . Magnetic content . . . and Bulk density must all meet rigid standards.

RESULT: DEPENDABLE PERFORMANCE

You can *depend* on (PD) WHEELS because each reorder wheel gives you exactly the same good job as the original.

Using (PD) WHEELS you will find production going up, and costs going down . . . *to stay!* This is the promise—and the *performance*—of Positive Duplication.

CALL FOR CINCINNATI WHEELS TODAY

Solve your grinding problems with the help of specialists trained by the Cincinnati Milling Machine Company. Their wide experience in job set-ups and grinding operations is at your service. Just call your CINCINNATI (PD) GRINDING WHEELS Distributor or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

(PD) POSITIVE DUPLICATION

CINCINNATI°

GRINDING WHEELS

°Trade Mark Reg. U.S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

Cutler-Hammer cuts costs

In 1951, following mechanical improvements on the hydraulic system powering its plastic molding presses, Cutler-Hammer found that oxidation and emulsification of a low-grade hydraulic oil resulted in sticking valves, high oil consumption, costly replacement of worn main ram packings. Change to a premium Mobil oil and installation of a centrifuge for water and contamination removal reduced ram packing wear by 75% and resulted in a reduction in valve sticking and oil consumption. After 9 years, with periodic oil analyses by Mobil, the original fluid fill is still in service. Savings: $5,484 in 1959 alone.

Mobil

with Mobil — saves $13,300!

Leading manufacturer of engineered electrical systems benefits from Mobil Correct Lubrication, realizes economies in wide range of operations, saves $13,300 in one year alone

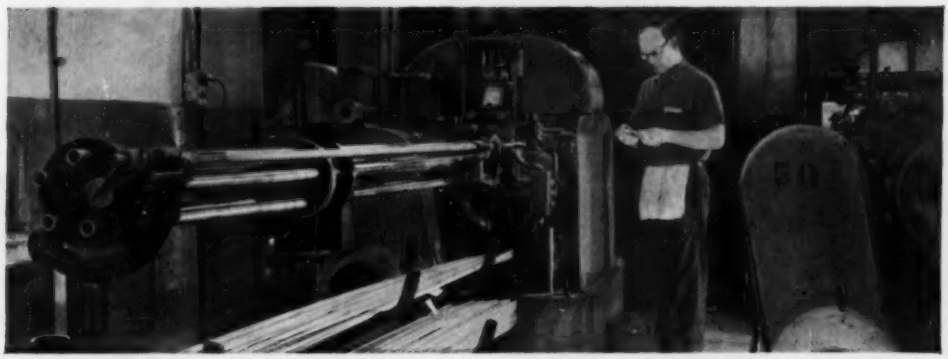
A pioneer in the production of electric controls, Cutler-Hammer, Inc., has for many years relied on a Mobil Program of Correct Lubrication for its several Milwaukee plants. The Mobil Program has consistently brought benefits to Cutler-Hammer—in terms of increased production efficiencies and maintenance dollar savings.

Working in close liaison with Cutler-Hammer technical personnel, Mobil Engineers have made recommendations and suggestions in many areas where lubrication is a factor. These recommendations—a few of which are itemized below—resulted in a saving of $13,300 to Cutler-Hammer in 1959.

Your plant may profit from a Mobil Program too. For further information, call your Mobil Representative. Or write, Mobil Oil Company, 150 East 42nd Street, New York 17, New York.

To guide lubrication personnel in performing required services, Mobil developed complete lubrication charts for machines at Cutler-Hammer, worked out oiler routes and schedules, and recommended use of time-saving lubrication cart. Increased efficiency permitted reassignment of a maintenance man, reduced other overhead, saved $7,452 in 1959—principally in the Press Department.

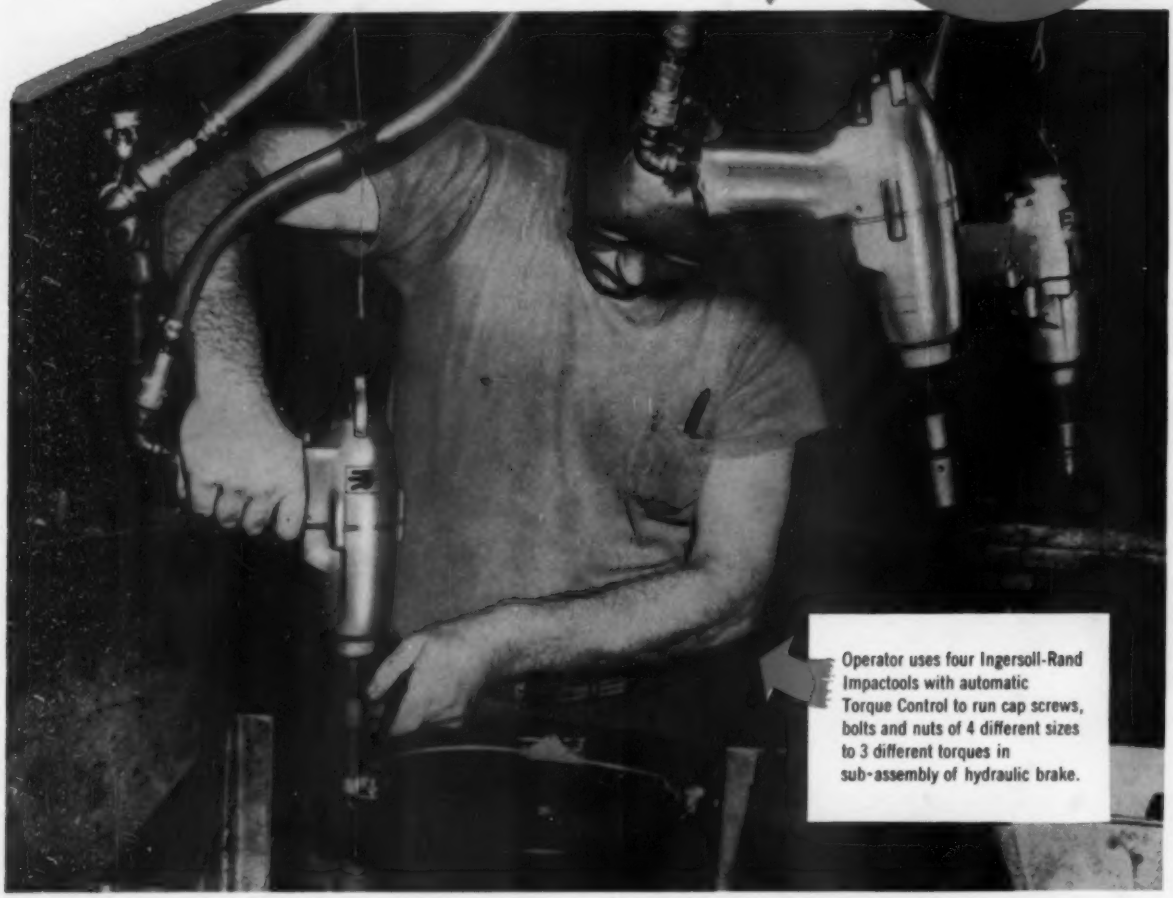
A Mobil recommendation covering quantity deliveries of oils and greases proved advantageous to Cutler-Hammer. After studying Cutler-Hammer's requirements, Mobil recommended that lubricant purchases be consolidated to permit carload deliveries beginning in 1955. These carload deliveries made possible discount savings which last year amounted to $364.



In Cutler-Hammer's screw machine department, a central cutting oil system serves many machines. Contamination of cutting fluid by lubricating oil frequently reduced machining efficiency to the point where tolerances, tool wear, poor finishes and excessive smoking became serious problems. Mobil Engineers have helped greatly to reduce these problems by periodically analyzing cutting oil characteristics and after each analysis, prescribing corrective action to restore maximum machining efficiency.

Correct Lubrication

IMPROVE PRODUCT QUALITY PRODUCE 45% MORE AT THE SAME TIME!



Operator uses four Ingersoll-Rand Impactools with automatic Torque Control to run cap screws, bolts and nuts of 4 different sizes to 3 different torques in sub-assembly of hydraulic brake.

By replacing ordinary air and electric impact wrenches with Ingersoll-Rand "automatic shut-off" torque control Impactools, the problem of driving cap screws, nuts and bolts to 3 different and precise torques has been eliminated. Quality is assured!

At the same time . . . production on this job has increased by 34% to 45% per manhour depending on the model being assembled! And . . . this manufacturer has solved his "quality bottleneck" on 11 other operations with additional reliable high-production, Torque Control Impactools.

This extra output means a Dividend on Payroll Dollars for this manufacturer of from 34% to 45% of the operator's wages!

You can calculate your own dividend with the help of Ingersoll-Rand's new, illustrated guide-book, "How to earn a Dividend on Payroll Dollars with Planned Annual Retooling" . . . and handy Dividend Computer. Call your nearby I-R Representative or write Ingersoll-Rand, 11 Broadway, New York 4, N. Y.

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

Planned Annual Retooling increases output per man

43A-8

CIRCLE 204 READER SERVICE CARD ►

BERTHIEZ

Type BM 125
with fixed table

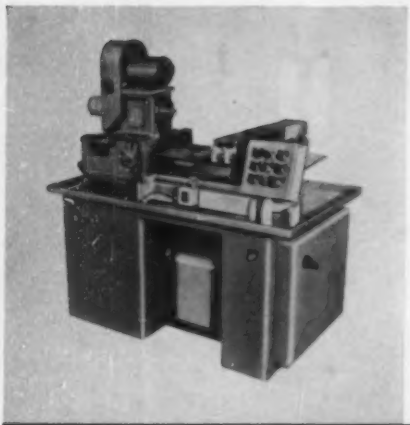
Single Upright VERTICAL BORING and TURNING MILLS

Type 9135
with displaceable table

Société Anonyme des Anciens Etablissements Charles BERTHIEZ Givors (Rhône)

JONES & LAMSON'S *NEW* PRECISION LINE of smaller machines

precision performers in the under $10,000 price range.



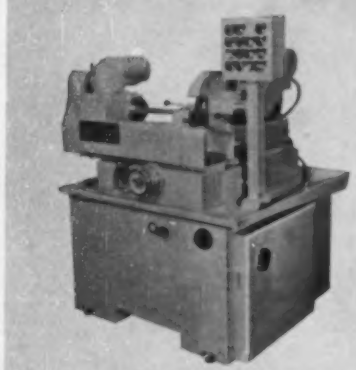
MODEL 6 PRECISION BORING MACHINE

FEATURES:
- choice of three automatic cycles
- push button operation
- varied chucking for rotating either tools or work
- applicable for multiple spindles

write for folder #6016

SPECS:

Swing — 10″ dia. max., Stroke — 7⅛″ max.
Bore — .090″ dia. min., 3″ dia. max.



MODEL 410 PRECISION THREAD GRINDER

FEATURES:
- stark simplicity in set up and operation — push button control
- pre-packed work and wheel spindles — lubricated for life
- dual lead compensation (short & long)
- all machine slides are on pre-loaded rollers for smooth accurate traverse

write for folder #6015

SPECS:

Work Dia. — 4″ max., Thread Length — 10″ max.
Wheel Speeds — 2700 RPM

MODEL 6D PRECISION GUN DRILLING MACHINE

FEATURES:
- high penetration rates (12″ per min. not unusual)
- automatic cycling — push button control
- spindle distributes 12-15 gals. of coolant per min. at 2,000 PSI
- infinitely variable and constant feed rate

write for folder #6014

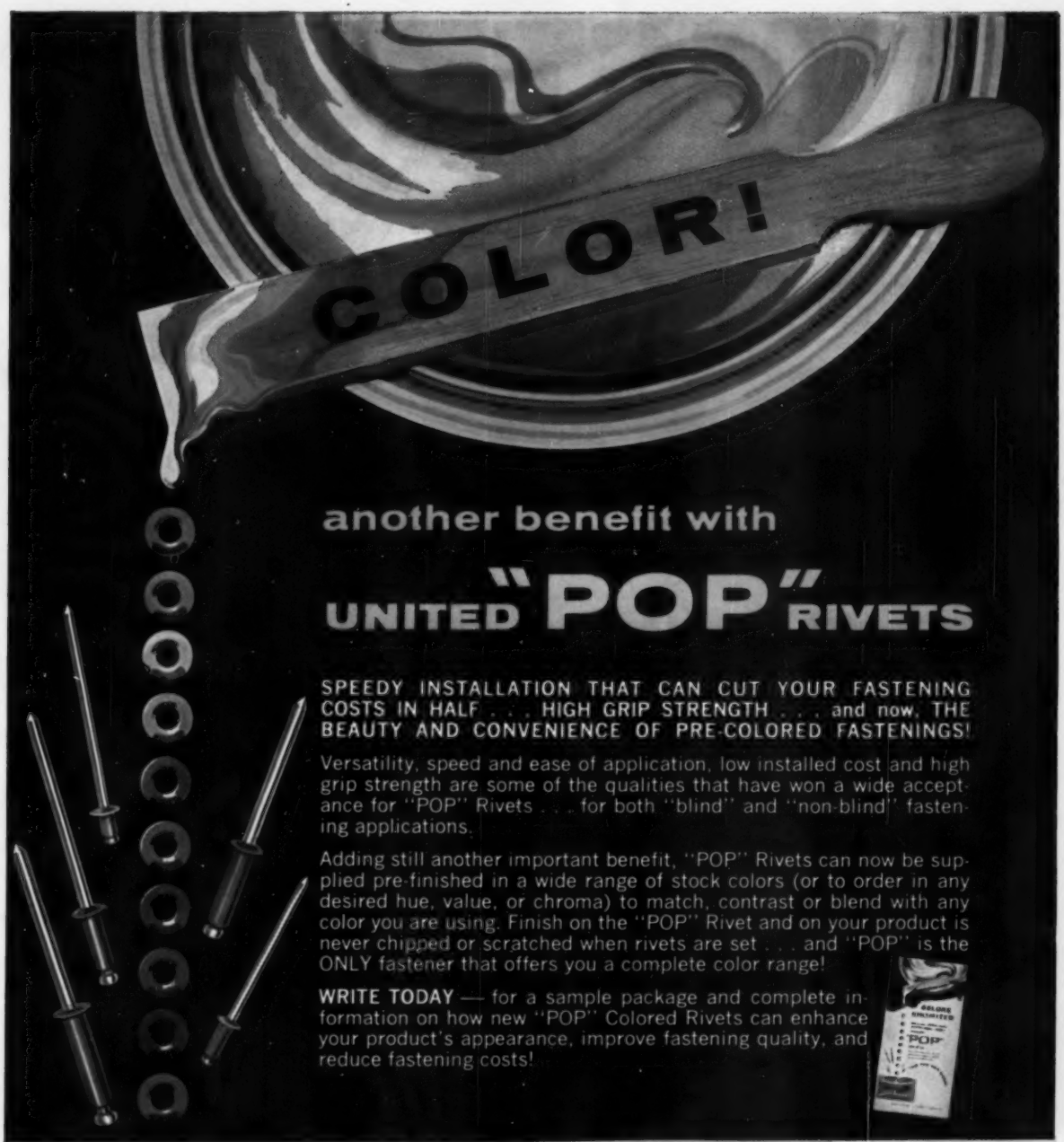
SPECS:

Spindle Speeds — 15,000 RPM, Max. Length of hole — 6″,
Dia. of hole — ½″ max., .074 min., Stroke — 7¼″ max.

JONES & LAMSON

THREAD TOOL DIVISION

Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vt., U. S. A.



another benefit with

UNITED "POP" RIVETS

SPEEDY INSTALLATION THAT CAN CUT YOUR FASTENING COSTS IN HALF . . . HIGH GRIP STRENGTH . . . and now, THE BEAUTY AND CONVENIENCE OF PRE-COLORED FASTENINGS!

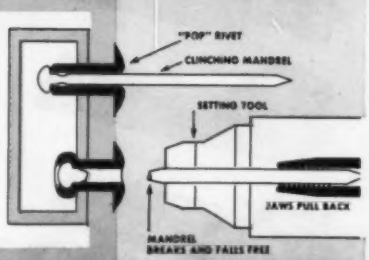
Versatility, speed and ease of application, low installed cost and high grip strength are some of the qualities that have won a wide acceptance for "POP" Rivets . . . for both "blind" and "non-blind" fastening applications.

Adding still another important benefit, "POP" Rivets can now be supplied pre-finished in a wide range of stock colors (or to order in any desired hue, value, or chroma) to match, contrast or blend with any color you are using. Finish on the "POP" Rivet and on your product is never chipped or scratched when rivets are set . . . and "POP" is the ONLY fastener that offers you a complete color range!

WRITE TODAY — for a sample package and complete information on how new "POP" Colored Rivets can enhance your product's appearance, improve fastening quality, and reduce fastening costs!

UNITED "POP" RIVETS

HERE'S HOW THEY WORK
"POP" Rivets are inserted and set from the same side: (1) "POP" Rivet (a hollow rivet assembled on a solid mandrel) is inserted in the work. (2) Jaws of the easy-to-use setting tool grasp the mandrel. (3) Tool is operated. Jaws pull back. Rivet is set. Mandrel breaks and falls free.



"POP" RIVET DIVISION · UNITED SHOE MACHINERY CORPORATION
SHELTON, CONNECTICUT, U.S.A.

ARMSTRONG

TOOL HOLDERS

A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs.
Write for literature.

If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. CHICAGO 46, ILL.

WE ARE AT WAR!

No Paul Revere to warn us. But... America is at war. Economic war. A war of goods, figures, production quotas, exports, imports, markets, trade balances, foreign exchange. A war of technologies, skills, ideas... of men, methods, machines. A war America must win. The stakes are high. The challenge, clear, the hour, late. But industry still can choose. Modernize and go forward. Or... stagnate and decline.

At Pratt & Whitney **new** ideas, **new** processes and **new** equipment are producing America's finest machine tools, cutting tools and gages—products that can cut costs, increase production, make your product more competitive, salable, profitable.

Pratt & Whitney

HEADQUARTERS FOR AMERICA'S WAR AGAINST OBSOLESCENCE

machine tools / cutting tools / gages

A MAJOR INDUSTRIAL COMPONENT OF **FAIRBANKS WHITNEY CORPORATION**

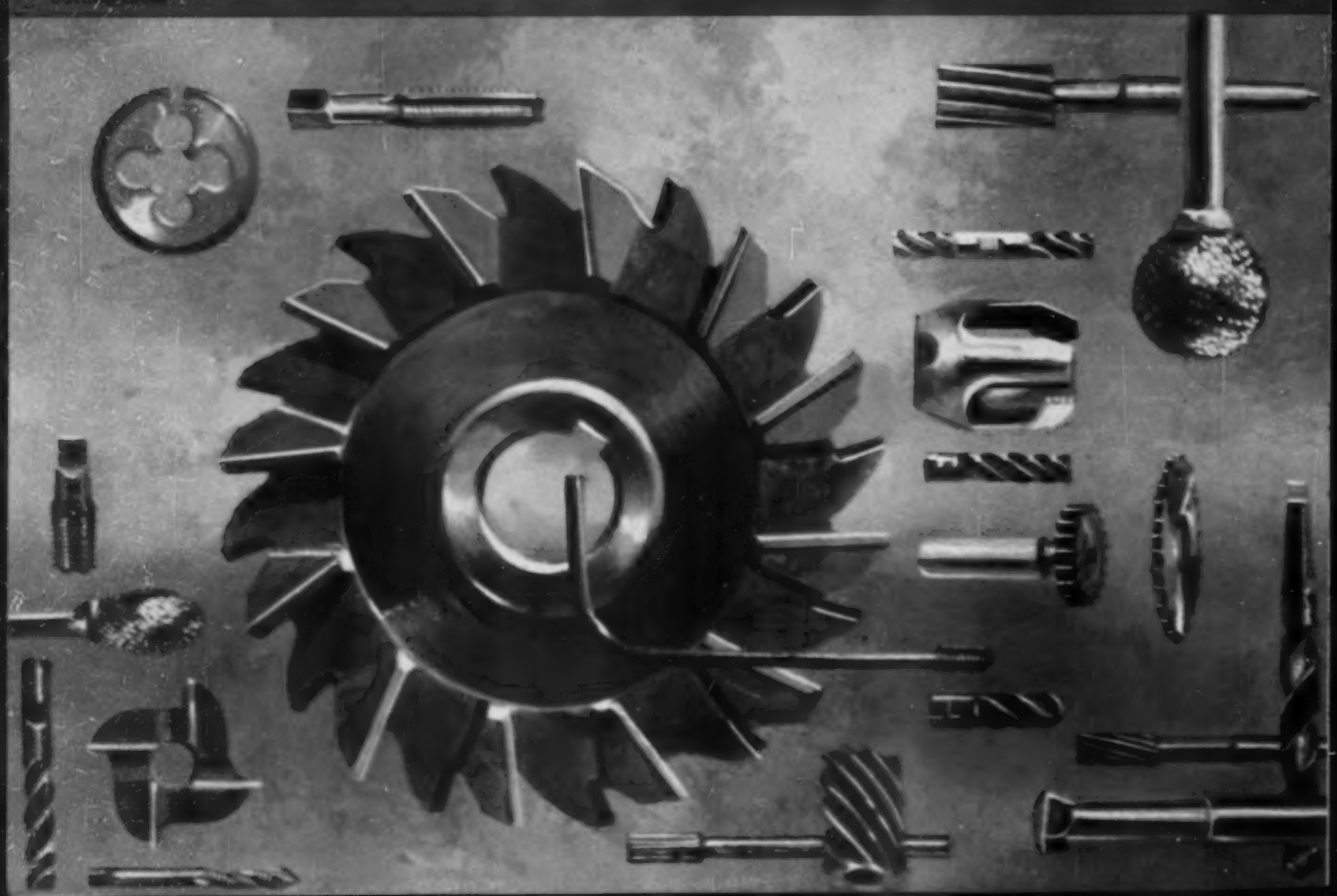
FIGHT OBSOLESCENCE... WITH P & W'S "WEAPONS" FOR GREATER PRODUCTIVITY AND PROFIT

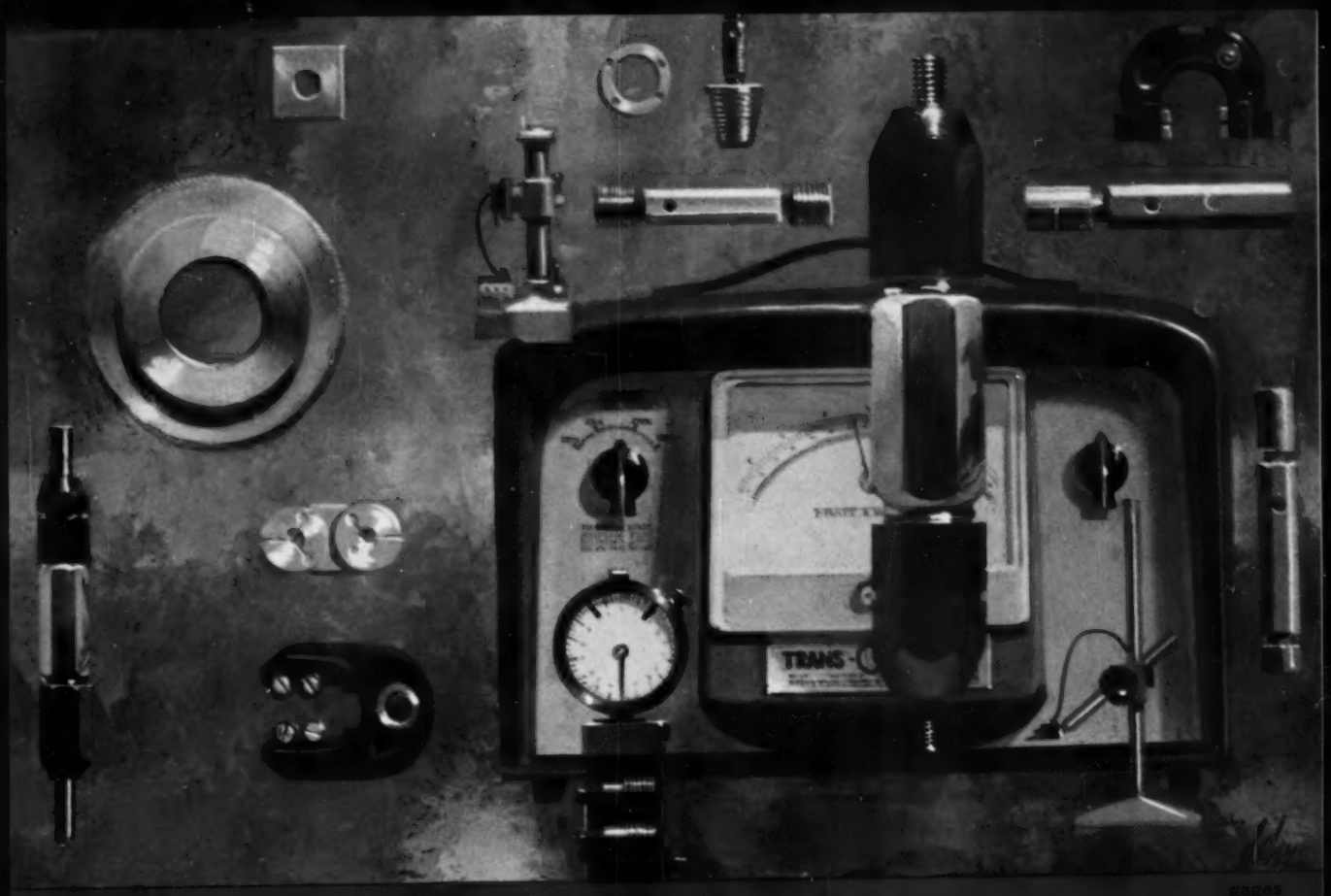
Bring your machinery or tooling modernization problem to Pratt & Whitney's "cost-cutting-conscious" sales engineers at our permanent machine and tool exhibition ... Centennial Hall, West Hartford, Connecticut, "Headquarters for America's War Against Obsolescence."

P&W MACHINE TOOLS Producing prototypes, dies, large or small lots of production parts? Ultra-precision locating (to "tenths" accuracy)? Boring, profile-milling (with or without masters)? All these and countless other problems can be solved with P&W machine tools at production line speed, efficiency and economy. Machines such as the world-famous **P&W KELLER,®** **P&W JIG BORER, P&W ROTARY TABLE** and **P&W POTTER & JOHNSTON AUTOMATIC TURRET LATHE** are available with manual or numerical controls in a variety of models to fit your needs. P&W can also supply the **MAGNETRACE PROFILER, SIM LATHE, INNOCENTI-MITSUBISHI MILL** and the **DIAFORM WHEEL FORMING ATTACHMENT**... high grade performers all. For more information or expert advice ask your P&W representative.

P&W CUTTING TOOLS A machine tool's performance is no better than the cutting tool it drives. You can be sure your cutting tools will deliver the full dollar value of your machine if they're made by Pratt & Whitney. Incorporating the latest in tool geometry, metallurgy, and manufacturing techniques, P&W cutters pay off in increased production, higher work quality, lower final tooling costs. Investigate our complete line of **DRILLS, TAPS, DIES, MILLING CUTTERS, REAMERS, BURRS** and **END MILLS** ... in HSS and solid carbide. All are available now through selected industrial distributors in your area. For full information or special-problem help, call on a P&W factory-trained sales-service engineer.

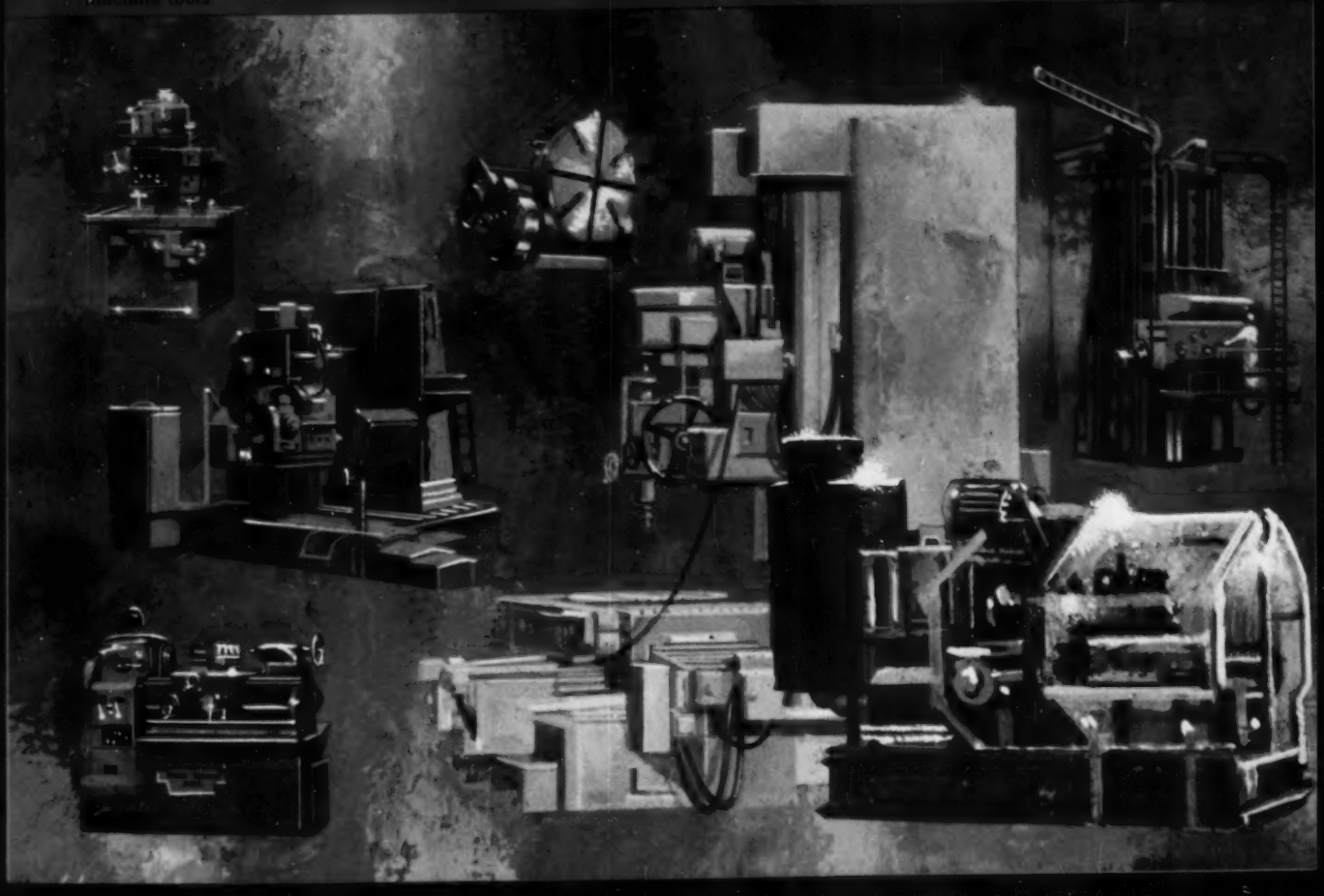
P&W GAGES More than ever, production efficiency depends on fast, precise, economical gaging. P&W supplies all types of gaging equipment. Thus, you can choose those that do your job at lowest cost ... from the most intricate tape-controlled **INSTRUMENT GAGES** to simple **CONVENTIONAL GAGES.** Types include **PLUG, RING, THREAD** and **SNAP GAGES, INTERNAL** and **EXTERNAL COMPARATORS,** and **PRECISION GAGE BLOCKS** ... all available through industrial distributors. The exclusive series of **AIR-O-LIMIT,®** **SIGMATIC,®** **TRANS-O-LIMIT®** and **DATA-LIMIT®** gages and the famous **"FLYING MIKE" CONTINUOUS GAGE** are available from your P&W representative. Bring your gaging problem to him.





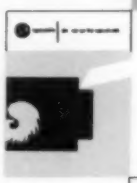
gages

machine tools



These are some of the many detailed bulletins available on world famous Pratt & Whitney machine tools, cutting tools and gages.

THE P&W, POTTER & JOHNSTON® AUTOMATIC TURRET LATHE is the fastest, most efficient automatic turning machine on the market today. The addition of inexpensive tape control further reduces setup and operating times and assures "management control" over production rate . . . thus providing predictable profits. Write for Bulletin No. A11.



THE P&W SIM LATHE is a production machine capable of taking the heaviest cuts in small and medium lot turning operations—as well as the most delicate cuts on frail work-pieces—to extremely close tolerances . . . all ECONOMICALLY. Write for Bulletin No. A52.

THE NEW P&W MAGNETRACE® PROFILER will perform tracer controlled, profile milling operations previously thought impossible. Extremely fast (up to 80" per minute) and accurate (a stylus deflection of only .0002" will activate the drive mechanism), the Magnetrace must be seen in operation to be believed. Write for Bulletin No. A51 or visit Centennial Hall to see it in action.

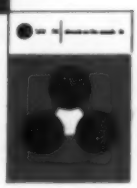
PRATT & WHITNEY TAPS are the finest available anywhere. They're made of the finest materials, on the best equipment, with the latest manufacturing techniques and tool geometry know-how. They insure the highest number of tapped holes per tool. Write for Bulletin No. B11.

PRATT & WHITNEY END MILLS feature advanced tool geometry for more cutting edge rigidity; and exceptionally sharp, smooth, cutting teeth. This results in longer tool life and better work finishes. Write for Bulletin No. B21.

PRATT & WHITNEY BLUE HELIX® DRILLS – new with P&W – are made to the same standards of quality as the famous Blue Helix Reamers which have a world-wide reputation for quality. Made from the finest high speed steel to proven cutting tool geometry, they are expertly heat treated and specially surface hardened. This lengthens useful life, boosts accuracy and reduces chip abrasion. Write for Bulletin No. B61.

PRATT & WHITNEY TRANS-O-LIMIT® COMPARATORS are an entirely new line of completely transistorized, precision measuring instruments. The Trans-O-Limit Cabinet, used in conjunction with the Trans-O-Limit Height Gage, External Comparator, Cartridge Unit, or Snap Gage, provides the ultimate in gaging stability and precision. Write for Bulletin No. D11.

PRATT & WHITNEY HOKE® AND U.S.A. PRECISION GAGE BLOCKS are available in both steel and solid carbide. Accuracy is unconditionally guaranteed within a few millionths of an inch. They're used individually or wrung together in stacks, to produce any desired measurement in calibrating a wide variety of working gages. Write for Bulletin No. C11.



PRATT & WHITNEY TRI-ROLL® THREAD ROLL COMPARATORS provide fast, accurate dimensional analysis of threads, to insure acceptance of only those screws or fasteners that meet your standards. They check taper, out-of-roundness, deviations in lead and angle, and low limit pitch diameter. Write for Bulletin No. C21.

Pratt & Whitney

HEADQUARTERS FOR AMERICA'S WAR AGAINST OBSOLESCENCE

machine tools / cutting tools / gages

A MAJOR INDUSTRIAL COMPONENT OF **FAIRBANKS WHITNEY CORPORATION**

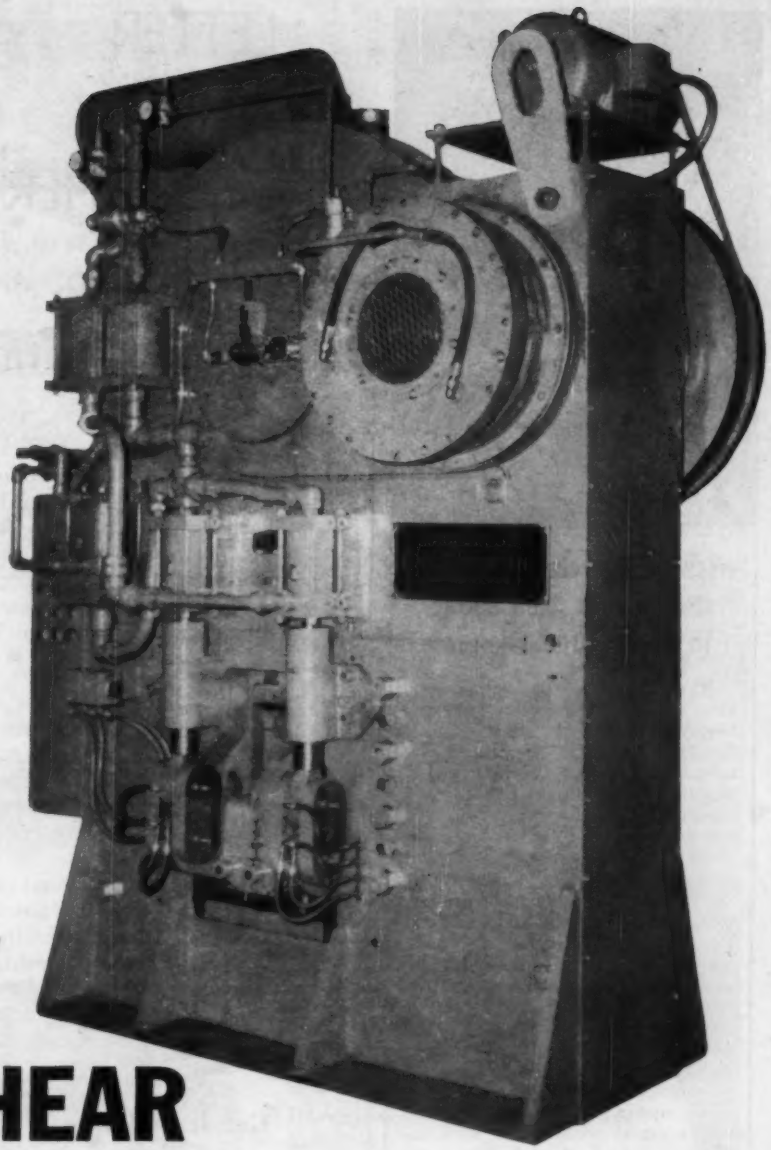
PRATT & WHITNEY COMPANY, INCORPORATED, CHARTER OAK BOULEVARD, WEST HARTFORD, CONNECTICUT

HIGH SHEARING SPEED—Up to 18,000 cuts per 8 hour shift.

CLEAN, SQUARE CUTS—Shows up hidden defects.

COMPACT DESIGN—Saves floor space.

AUTOMATIC FEED TABLES—Available to your requirements.



'BUFFALO' BILLET SHEAR

Now—enjoy peak production on your billet cutting jobs. This new 'Buffalo' Billet Shear is ruggedly-built for maximum years of dependable, trouble-free performance. Greatest output at lowest cost is assured by efficient high speed operation. Clean, square cut billets permit high quality finished forgings. Features include alloy steel frame, electrical controls and pneumatic automatic oiling system.

For full details, including capacities available, contact your machine tool dealer or write us direct.

MACHINE TOOL DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

◀ CIRCLE 211 READER SERVICE CARD

CIRCLE 212 READER SERVICE CARD

New $300 precision cut-off saw paid for itself during 15 minute production run

Navkut*, the new precision cut-off saw, cut production costs substantially at Unicorn Engineering Inc. (now owned by Computer Measurements Company, Sylmar, California). $8 was once the cost of "spacers"—high precision parts which were originally cut from bar stock in a lathe, then milled and ground to a tolerance of .002". After buying the Navkut saw, the production of spacers was reduced to a simple cut-off operation, and costs were cut to 80c a spacer. During every 15-minute production run, the Navkut saw paid for itself. Today, over two years later, the same Navkut is still being used to great advantage in a wide variety of production work.

An operator can cut parallel tolerances to within .002" with the Navkut cut-off saw. And in most cases, the cut finish and accuracy are so precise there is no need for milling or grinding. The Navkut saw will cut ferrous, non-ferrous, wood, and plastic materials with only two types of blades. It sets up in just 1½ minutes. And yet, with all this precision, the Navkut saw costs only $300.

This is the ideal production cut-off for small shops; the ideal auxiliary cut-off for all shops. See for yourself how the Navkut saw can save you money. Write today for a free 15-minute demonstration in your shop.

*TRADEMARK

Navkut saw is another product marketed by:

NAVAN

NAVAN PRODUCTS INC.

Subsidiary of
North American Aviation, Inc.
900/H North Sepulveda
El Segundo, California

LETTER from the PUBLISHER

The Solution Is Simple

As business papers seem to come endlessly across your desk or back issues pile up, you probably say to yourself: "When will I ever find time to read them all?" Perhaps you sometimes cross your name off a routing list, not having opened the paper (and do this with a twinge of conscience). Yet you **know** that you have to read to keep up on new production techniques. The problem is how to do it in a minimum of time.

Be selective . . .

There is only one solution to your problem: Be selective. Read only the best. You don't have to read or even look at all the papers that you are getting now (it must be five or six or even more, according to a recent survey). Here are a few suggestions on how to go about picking the best paper for your needs:

- Choose the paper that reports new developments first, that is reliable and authoritative, that gives you the truth rather than what the editors think you may wish to hear, that covers your field completely rather than specializing in one facet thus making you turn elsewhere for further news. If you do this, you will find that one paper, or at the most two, will give you all that you want.

Get it at home . . .

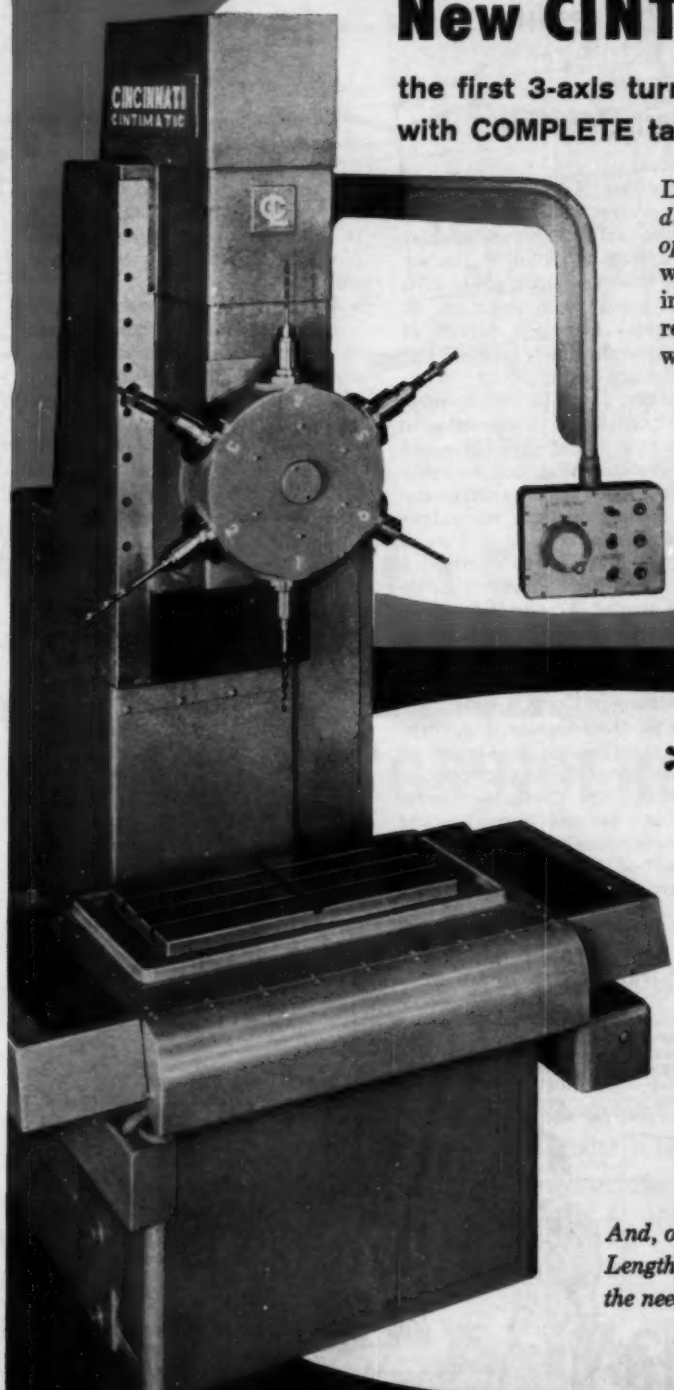
- Write to the papers you no longer wish to receive and ask them to stop sending them.
- Have the paper that you select sent to your home. If you really are serious about being better informed, that is where you will have the time to read.

Once you have made your choice and you settle down to reading the "most authoritative paper" regularly, no important happening in your field is likely to escape your attention. And you won't suffer that "twinge of conscience."

George Reppert

New CINTIMATIC...

the first 3-axis turret drill with COMPLETE tape control*



Drill, tap, ream, counterbore PLUS *dwell, finish bore, and light milling operations!* Here's toolroom versatility with production economies—and, amazingly fast set-up that brings the cost reductions of automation to short-run work.

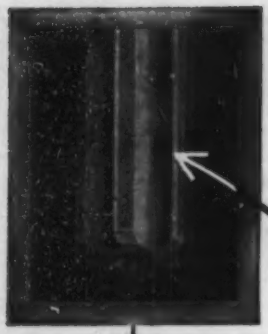
Your Cincinnati Lathe and Tool Distributor will help evaluate the application of CINTIMATIC automation to your drilling jobs. Or, write for catalog.

* **Only CINTIMATIC automatically controls selection of all machining functions entirely by tape!**

- Feed selection for both turret and table
- Random tool selection from six spindles
- Automatic positioning of work table with 16″ x 30″ travel
- Multiple depth selection for each spindle
- Selection of 16 spindle speeds for each spindle
- Tap, dwell, and milling cycles

And, only CINTIMATIC *provides "Tool Length Compensator"—eliminates the need for controlled tool length.*

CINCINNATI LATHE AND TOOL CO.
CINCINNATI 9, OHIO
HYDRASHIFT Lathes / CINCINNATI Drilling Machines / SPIROPOINT Drill Sharpener
CINTIMATIC Numerically Controlled Lathes and Drills



This edge cuts reaming costs

L+I gives you the edge on production

Call your L+I distributor

The Reamer Specialists

L&I

LAVALLEE & IDE, INC.
CHICOPEE, MASS.

LETTERS

to the editors

330 W 42nd St, New York 36, NY

Adjustable-speed Drives

Dear Sirs:
I have read with great interest the rather comprehensive article on "How to select an adjustable-speed drive," by John W Harper (*AM/MM*—Dec 12 '60, p99). It is a great pleasure to see such an intelligently arranged survey of such a complex and, to some extent, obscure field.

However, I would like to offer a few additional comments to cover a new line of variable-speed drive systems that has recently been developed and to enlarge the scope of specifications for saturable-reactor drives.

The new and additional category of variable-speed drives is based on the use of a solid-rotor, a-c, squirrel-cage motor in conjunction with a magnetic-amplifier control package. Manufactured by Fidelity Instrument Corp, a subsidiary of Miehle-Goss-Dexter, Inc, these drives are suitable for almost all variable-speed-drive applications.

A variety of characteristics is available, because they all use tachometer feedbacks as an integral part of the motor design. The standard range at present is fractional to 20 hp, but Fidelity plans to extend the range.

The control system is entirely static, solid-state, and non-electronic. The only moving parts are in the motor, which does not employ any slip rings or brushes of course.

Additionally, these drives are available with reversible features employing completely static controls through the use of the control windings of the magnetic amplifiers used. Controllability is excellent with low-power-level potentiometers suitable for remote mounting. An externally powered constant-speed cooling blower permits continuous low-speed operation.

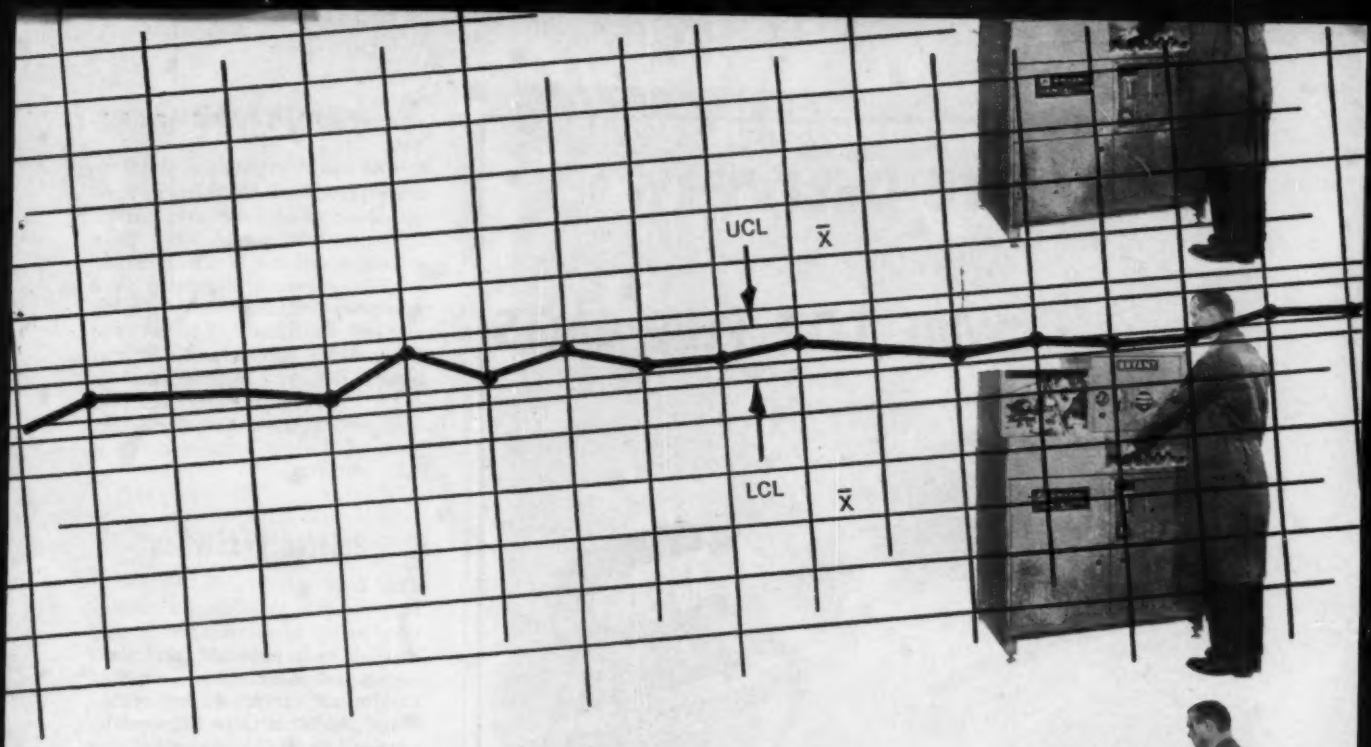
My other comments have to do with the characteristics shown on p101 for saturable-reactor drives. The table does not, in my opinion, describe the full capabilities available in these drives.

The saturable-reactor-magnetic-amplifier - controlled, variable-speed, d-c drives manufactured by Fidelity Instrument Corp have the following additional capabilities:
1. The standard constant-torque speed range is 15:1, and a 50:1 speed range is available and can

SHOPMATES

N. Jarvis

—FORMING TOOL FOR THE AUTOMATICS ??
I'M WORKIN' ON THE PATTERN ···· FOR THE TEMPLATE ··· FOR THE WHEEL DRESSER ···· FOR THE GRINDING FIXTURE ···· FOR THE CUTTING TOOL ··· FOR THE FORMING TOOL!
N. JARVIS



TEST CURVES LIKE THIS PROVE OUT BRYANT GRINDERS

The test curve above is typical. It shows the average size variation of the I.D. in a run of sample parts ground to customer specifications on a Bryant Internal Grinder. From this curve and other data, Bryant engineers evaluate the machine's *long term* precision capabilities, using mathematical laws of probability. Result: a job-engineered machine, tested under actual production conditions — *proved out* by statistical quality control methods. Logical reasons why a Bryant Production Internal Grinder is best suited to maintain the required quality standards in *your* plant. Contact your nearest Bryant or Ex-Cell-O sales representative for full details.

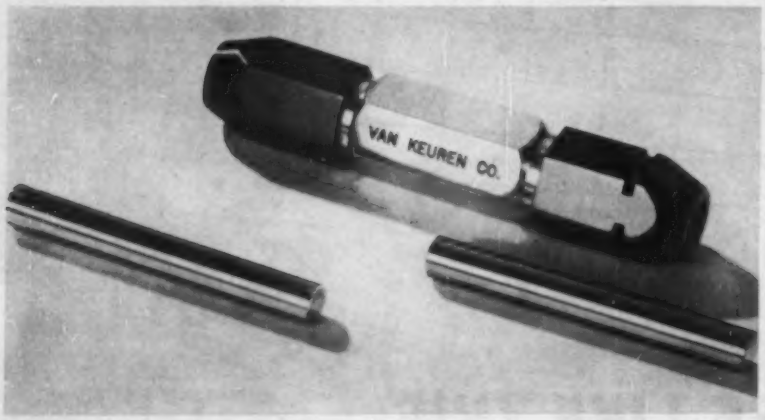
This Model "B" Centalign® provides quick changeover and high precision on short or long production runs of small workparts.

BRYANT
Chucking Grinder Co.
10 CLINTON STREET, SPRINGFIELD, VERMONT, U.S.A.
Internal Grinders • Special Machinery

CIRCLE 216 READER SERVICE CARD

IMMEDIATE DELIVERY

Van Keuren WIRE TYPE PLUG GAGES



WIRE TYPE (REVERSIBLE) PLUG GAGES were originated by **THE VAN KEUREN CO.** in 1923, and since that time have been supplied to an ever expanding group of manufacturing concerns throughout the country and abroad. The wire type design has enjoyed tremendous popularity because of the inherent economy represented by the fact that the gage units can be reversed, or cut off, to obtain substantial increase in gage life.

As a result of our long experience in developing and pioneering the manufacture of wire type plug gages and the sale of millions of these units, we have come to know what sizes will be required during a given period of time, and have prepared ourselves by finishing in advance a multitude of units which are in constant readiness for shipment. Our methods of size prediction through research and sales analysis have been successful to the point that there is now better than a four out of five chance that at any time we will have on hand the gage or gages that you need. In addition improved and highly efficient methods of manufacture developed during the years of our work in this field make possible the manufacture, to your requirement, of any size not on hand, in an incredibly short time.

VAN KEUREN WIRE TYPE PLUG GAGES are made to the most exacting requirements as to diameter, roundness, hardness, stability and surface finish. They are offered in all tolerances from XXX (.00001") to ZZ, and are available as units, in handles, or in sets.

THE **VAN KEUREN** CO.
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
. . . rated the world's most accurate

Plug Gages • Measuring Wires • Optical Flats and Light Wave Equipment • Gage Blocks
Precision Lapping Service and Parts

CIRCLE 217 READER SERVICE CARD

be ordered as a special modification.
2. The speed regulation is 1% in accordance with Mr Harper's definition of steady-state regulation.
3. Controlled acceleration is a standard feature of these drives.
4. The standard regulator is a magnetic amplifier, with feedback circuits containing integral and derivative feedback paths to provide anti-hunt characteristics.

George Roberts, *vice pres*
Western Automation Inc
Placentia, Calif

Belated Resolution

Dear Sirs:
Is it too late to suggest a resolution, by all of us engaged in chip making, to emphasize higher metal-removal rates and shorter edge life for all our machining operations? And this to be followed by a second resolution that we of this group list as MUST reading, "On the Art of Cutting Metals" by Taylor (1906), in which he scorches those who convert everything into longer tool life, to the effect that anyone who brags about keeping a tool on the job longer than 1½ hr simply proves how little he knows about metal removal.

In these profit-squeezed days we need to keep reducing tool life to a minimum—not longer than 10 to 15 min with indexable carbides —with corresponding increases in metal-removal rates. For every unit increase in tool cost under this minimum-tool-life regime, value of salable product has increased ten units or more.

Horace Frommelt, *director*
Manufacturing Research Center
Ferro Powdered Metals, Inc
Salem, Ind

"Looks like we'll need that buck if we're going to meet the payroll this week."

CALENDAR

American Institute of Mining, Metallurgical, & Petroleum Engineers—Annual Meeting, Feb 26-Mar. 2, Chase-Park Plaza Hotel, St. Louis, Mo.

Society of Automotive Engineers—National Automobile and Production Meetings, Mar 13-17, The Sheraton-Cadillac, Detroit.

American Society for Metals — Western Metal Show, Mar 20-24, Pan-Pacific Auditorium, Los Angeles, Calif.

Pressed Metal Institute — Spring Technical Meeting, Mar 22-24, Belmont Plaza Hotel, New York, NY.

American Machine Tool Distributors Association — Spring Meeting, Mar 23-25, Hotel Mark Hopkins, San Francisco, Calif.

Society of Automotive Engineers—National Aeronautic Meeting & Display, Apr 4-7, Hotel Commodore, New York, NY.

American Welding Society — Annual Meeting and Welding Show, Apr 17-21, Commodore Hotel and Coliseum, New York.

National Institute for Disaster Mobilization—Mutual Aid and Disaster Control Seminar, Apr 18-20, Shamrock Hilton Hotel, Houston, Texas.

American Society of Mechanical Engineers — Metals Engineering Conference, Apr 23-26, Penn Sheraton Hotel, Pittsburgh, Pa.

Metal Powder Industries Federation — Annual Meeting and Powder Metallurgy Show, Apr 24-26, Hotel Sheraton-Cleveland, Cleveland, Ohio.

American Institute of Mining, Metallurgical, & Petroleum Engineers—High-Temperature Materials Conference, Apr 26-27, Carter Hotel, Cleveland, Ohio.

National Screw Machine Products Association—Annual Meeting, Apr 29-May 3, Summerset Hotel, Boston, Mass.

American Foundrymen's Society—Castings Congress and Exposition, May 8-12, Brooks Hall and Civic Auditorium, San Francisco, Calif.

For Precision Threading and Forming
with Single and Multi-revolution Dies

NEW— Thread Rolling Machine

The Reed B150 Cylindrical Die Thread Rolling Machine is a rugged general purpose two die machine. Its wide range of capacity and versatility meets the demand for both the small lot as well as mass production.

The Standard B150 Machine is arranged for multi-revolution dies with servo cam controlled in-feed operation. Work diameter capacity is from 3/16" to 5"

The B150 Machine may be arranged for high speed production by the addition of automatic work handling equipment and single revolution dies. Work diameter capacity is 3/16" to 1"

Write for Machine Bulletin B-150-1

REED RTD B-150-1

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

HOLDEN, MASSACHUSETTS, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

BATH *Tap'n Gage* TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

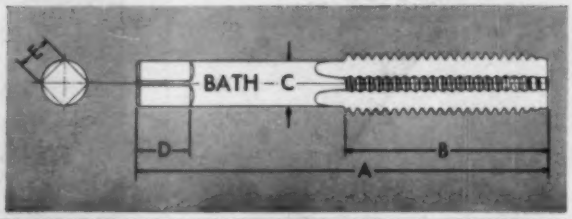
Vol. 1 No. 20

Subject: Making use of Standard Blanks for Special Taps:

Special taps can be furnished at a lower cost and delivered faster if your tapping application is such that standard tap blanks can be used in their manufacture instead of starting them from unhardened bar stock.

Taps made from standard blanks can be shipped in a matter of a day or two when delivery is an important factor in your threading requirements.

Bath maintains a large stock of standard blanks in a variety of flutes. These blanks are hardened, ground and ready for thread grinding. Some of the sizes carried in stock, for your convenience, are shown in the tables below.



TYPE	SIZE	A LENGTH OVERALL	B LENGTH OF THREAD	C SHANK DIAMETER	D LENGTH OF SQUARE	E WIDTH OF SQUARE
HAND TAP BLANK REGULAR LENGTH	¼	2½	1	.255	5/32	.191
	5/16	2 23/32	1 1/16	.318	5/16	.238
	3/8	2 15/16	1 1/4	.381	3/8	.286
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	9/16	3 5/16	1 13/16	.480	9/16	.360
	11/16	4 1/32	1 13/16	.542	5/8	.406
	3/4	4 1/4	2	.590	11/16	.442
	13/16	4 13/32	2	.652	3/4	.489
	7/8	4 7/16	2 1/32	.697	13/16	.523
	15/16	4 19/32	2 1/32	.760	7/8	.570
	1	5 1/8	2 1/2	.800	15/16	.600
	1 1/16	5 3/16	2 1/2	.896	7/8	.672
	1 1/8	5 5/16	2 1/2	.896	7/8	.672
	1 1/16	5 3/16	2 1/2	1.021	1	.766
	1 1/8	5 3/4	2 1/2	1.021	1	.766
	1 3/16	5 3/4	2 1/2	1.108	1 1/16	.831
	1 1/16	6 1/16	3	1.108	1 1/16	.831
	1 7/16	6 1/16	3	1.233	1 1/16	.925
	1 1/2	6 1/4	3	1.233	1 1/16	.925
	1 5/8	6 13/16	3 1/2	1.305	1 1/16	.979
	1 3/4	7	3 1/2	1.430	1 1/4	1.072
	1 7/8	7 1/16	3 1/2	1.519	1 1/16	1.139
	2	7 1/8	3 1/2	1.644	1 1/16	1.233
	2 1/16	8	3 1/2	1.769	1 1/16	1.327
	2 1/4	8 1/4	3 1/2	1.894	1 7/16	1.420
	2 5/16	8 1/2	4	2.019	1 1/16	1.514
	2 1/2	9 1/4	4	2.100	1 1/2	1.575
MACHINE SCREW TAP BLANKS	0	1 5/8	5/16	.141	3/32	.110
	1	1 11/16	3/8	.141	3/32	.110
	2	1 3/4	7/16	.141	3/32	.110
	3	1 13/16	1/2	.141	3/32	.110
	4	1 7/8	5/8	.141	3/32	.110
	5	1 15/16	5/8	.141	3/32	.110
	6	2	11/16	.141	3/32	.110
	8	2 1/16	3/4	.168	1/4	.131
	10	2 3/16	7/8	.194	1/4	.152
	12	2 5/16	13/16	.220	5/32	.165
	14	2 1/2	1	.255	5/32	.191
NUT TAP BLANKS	1/4	5	1 1/16 & 1 1/16	.185	5/16	.139
	5/16	5 1/2	1 1/16 & 1 13/16	.240	9/16	.180
	3/8	6	1 1/2 & 2	.294	11/16	.220
	7/16	6 1/2	1 3/4 & 2 1/16	.345	3/4	.259
	1/2	7	1 7/8 & 2 1/2	.400	7/8	.300
	5/8	7 1/2	2 & 2 1/16	.450	7/8	.337
	3/4	8	2 1/16 & 3	.503	15/16	.377
	7/8	8 1/2	2 1/16 & 3	.565	1	.424
	1	9	2 1/2 & 3 1/16	.616	1	.462
	1 1/8	9 1/2	3 1/16	.679	1 1/16	.509
	1 1/4	10	2 1/16 & 3 1/16	.727	1 1/16	.545
	1 3/8	10 1/2	3 1/16	.789	1 1/16	.592
	1 1/2	11	3 1/16 & 4	.854	1 1/16	.625

TYPE	SIZE	A LENGTH OVERALL	B LENGTH OF THREAD	C SHANK DIAMETER	D LENGTH OF SQUARE	E WIDTH OF SQUARE
HAND TAP BLANKS SHORT LENGTH	1 1/16	4	1 1/2	.896	7/8	.672
	1 1/16	4	1 1/2	.896	7/8	.672
	1 3/16	4	1 1/2	1.021	1	.766
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	1 1/16	4	1 1/2	1.233	1	.925
	1 1/2	4	1 1/2	1.233	1	.925
	1 1/16	5	2	1.305	1 1/16	.979
	1 1/16	5	2	1.430	1 1/4	1.072
	1 7/8	5	2	1.519	1 1/16	1.139
	2	5	2	1.644	1 1/16	1.233
	2 1/16	5 1/4	2	1.769	1 1/16	1.327
	2 1/4	5 1/4	2	1.894	1 7/16	1.420
	2 1/16	5 1/4	2	2.019	1 1/16	1.514
	2 1/2	5 1/4	2	2.100	1 1/2	1.575
PULLEY TAP BLANKS	1/4	6,8	1	.255	5/32	.191
	5/16	6,8	1 1/16	.318	5/16	.238
	3/8	6,8,10	1 1/4	.381	7/16	.286
	7/16	6,8,10	1 3/16	.444	1/2	.333
	1/2	6,8,10, 12	1 23/32	.507	5/16	.380
	5/8	6,8,10, 12	1 15/16	.633	11/16	.475
	3/4	10,12	2	.759	3/4	.569
STRAIGHT TAPER TAP BLANKS	1/4	12	1 & 1 1/16	.185	—	—
	5/16	12	1 1/16 & 1 3/16	.240	—	—
	3/8	12	1 3/16 & 1 5/16	.294	—	—
	7/16	12	1 5/16 & 1 13/16	.345	—	—
	1/2	12	1 5/16 & 1 5/16	.400	—	—
	5/8	13	1 5/16 & 2 1/16	.450	—	—
	3/4	13	1 15/16 & 2 5/16	.503	—	—
STRAIGHT AND TAPER PIPE TAP BLANKS	1/16	2 1/16	11/16	.3125	3/16	.234
	1/8	2 1/16	3/4	.3125	3/16	.234
	1/8	2 1/16	3/4	.4375	3/16	.328
	1/4	2 5/16	1 1/16	.5625	7/16	.421
	3/8	2 5/16	1 1/16	.7000	1/2	.531
	1/2	3 1/16	1 1/16	.8875	5/8	.515
	3/4	3 1/4	1 1/16	.9063	11/16	.679
	1	3 3/4	1 1/4	1.1250	13/16	.843
	1 1/4	4	1 1/4	1.3125	15/16	.984
	1 1/2	4 1/2	1 1/16	1.3000	1	1.125
	2	4 1/2	1 1/16	1.8750	1 1/16	1.406

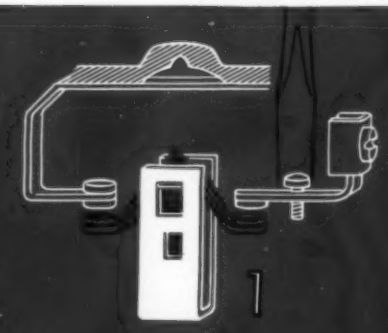
Whether your threading applications require standard taps or taps made from either standard blanks or unhardened bar stock, Bath can furnish properly designed tools for your specific tapping job that will result in the lowest cost per threaded hole. See your Bath distributor or write direct for further particulars.

• Cylindrical and Thread Gages • Ground Thread Taps • Internal Micrometers John BATH & Co., Inc.

22 Mann Street, Worcester, Mass.

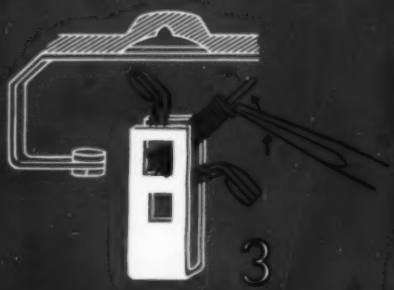
Four simple steps to contact changeover

Total time—not more than 60 seconds

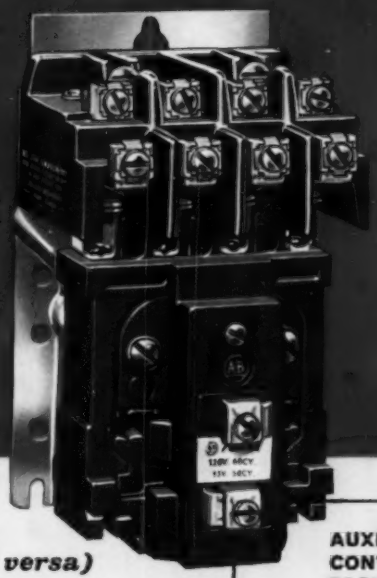


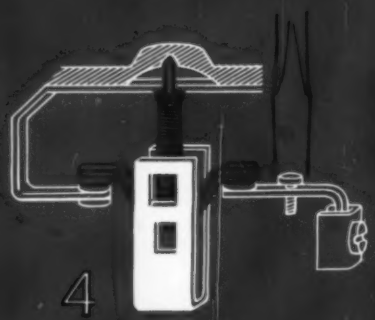
REMOVE FRONT STATIONARY TERMINAL

LIFT CONTACT SPRING AND ROTATE



DEPRESS SPRING AND TURN PIN STRAIGHT UP





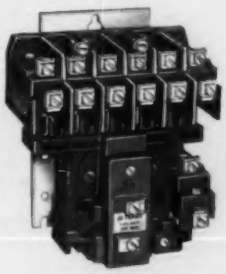
REPLACE TERMINAL IN REVERSE DIRECTION

Converts from N.O. to N.C. (or vice versa) in 60 SECONDS!

You'll be truly amazed at the ease of converting the contacts on these Allen-Bradley Bulletin 700 Type BR relays. Using only a screwdriver, as shown above, the contacts can be changed from N.O. to N.C. (or vice versa) in four easy steps—that take only *60 seconds!* Such convenient flexibility is a "natural" for reducing relay inventories.

The Type BR relays are built to provide *many millions* of trouble free operations. With the built-in permanent air gap, magnetic sticking is impossible. And the molded coil is impervious to *all* harmful atmospheres. Of course, the double break, silver contacts *never* need attention. If you use relays, there are money savings for you in the Type BR relay line!

AUXILIARY CONTACTS EASILY ADDED



Type BR relays are available with 2, 3, 4, or 6 poles—but as a valuable bonus, one or two fully rated poles can be added to the base of each relay—even in the field. It's a simple addition that takes only moments.

ALLEN-BRADLEY

Member of NEMA

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push button, also made with extended head.

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Combines push button and selector switch.

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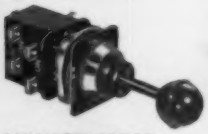

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Also furnished for 2-way operation.

PILOT LIGHT
Transformer or full voltage types.

DOUBLE CIRCUIT
Has 2 N.O. or 2 N.C. sets of contacts.

PILOT LIGHT CLUSTER
Four lights of different colors in one unit.

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QUALITY MOTOR CONTROL

SPOT NEWS...

- **Chrysler will gradually shut down its Imperial assembly plant,** with the final closing set for May 1961. Theoretically, operations will be transferred to the main Chrysler Div plant in Detroit. But it is safe to assume that the Imperial will henceforth be a deluxe version of the Chrysler. Chrysler is also closing a Detroit stamping plant employing 1400. Most operations will be moved to two other Detroit plants and to one in Twinsburg, Ohio.

- **A ferris-wheel arrangement lets inspectors view all four sides of billets** up to 4 in. square and 40 ft long. This Magnaglo billet inspection unit, built by Magnaflux Corp, is in operation at Cuyahoga (Ohio) Works of U S Steel, and is reported to be the largest such inspection device built to date.

- **Cross Co, Detroit, has won a U S Circuit Court of Appeals decision** setting aside UAW-CIO certification at its Detroit plant. Charges of unfair labor practices were dismissed and the judge suggested that new elections be held.

- **Russia built 154,000 metal-cutting machine tools in 1960** and 29,500 forging and pressing machines. More than 2800 automatic, semi-automatic, and mechanized transfer lines were put into production. 70,000 metal-cutting machine tools and "items of forging and pressing, foundry, woodworking, and other operating technological equipment have been modernized." Many regions and enterprises failed to meet targets for new equipment and many made outdated machines.

- **Three firms are in the running for a $2,250,000 NASA contract** for building first-stage fuel tanks for five huge Saturn launch vehicles. Of the 18 firms that submitted proposals, only Boeing (Seattle), Chance Vought (Dallas), and Martin (Baltimore) are still being considered. Deliveries to NASA are to begin in mid-1962; vehicles are scheduled to go into operation in 1964.

- **A $1.7-million British/Israeli metal-forging plant is being built in Haifa, Israel,** for production of ferrous and nonferrous forgings. Operations are expected to begin within one year, with an initial one-shift capacity of 2500 tons per year. Known as the Carmel Forge Co, new firm is a partnership between Argat Ltd (an Israeli government enterprise) and two British concerns, B S Massey (Manchester) and Forgings & Pressworks Ltd (Birmingham).

- **Ductile nickel-aluminum-alloy coating that protects steel or molybdenum** will withstand temperatures to 1800 F without oxidation, reports National Bureau of Standards. Nickel is first electrodeposited on the steel from a chloride-sulphate bath. Aluminum is then electroplated from a hot solution of potassium chloride, sodium chloride, and cryolite. The aluminum diffuses into the nickel, producing an alloy.

- **Sales of reinforced plastics will hit a record-breaking 271 million pounds** in 1961, it was predicted at the recent annual meeting of the Reinforced Plastics Div of the Society of the Plastics Industry. This figure will mark a 7% gain over 1960 sales and approximately 2% over the previous all-time high of 264 million pounds reached in 1959.

- **Gas-turbine-powered air-cushion vehicle**—the GEM III ground-effect machine —has been delivered to the U S Marine Corps by National Research Associates, Laurel, Md. It is reported to be the first such craft using a gas turbine. GEM III is 22 feet long, 12 feet wide, and has a design gross weight of 1835 lb. Powered by two 80-hp engines, it can lift more than twice its own weight and move at speeds up to 30 mph.

Precisionaire gages qualify parts and tolerances to tenths on as many as ten simultaneous dimension readings.

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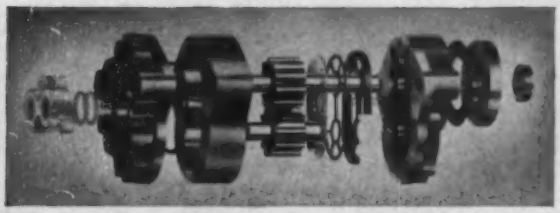

Six models of this Cessna hydraulic pump, used on farm and construction equipment, are gaged during production.

Honing machine operator checks valve body bore at 9 points at once, determines .0001" classifications.

"Without the proper type and quantity of gaging equipment, we never would have been able to produce such high quality hydraulic pumps, valves, and cylinders at such low relative costs," reports the Industrial Products Division of Cessna Aircraft Company.

Knowing that bad pumps correlate with lack of gaging equipment, Cessna has a complete set of gages for each model pump, ready to roll to the machines for quick setup and start of production. Thirty-five rolling gage cabinets, carrying more than 400 Precisionaire columns, are used in the production of these pumps.

All pump parts are produced to be completely interchangeable—there is no classifying or selective fitting. This results in minimum investment in parts inventory, a very rapid rate of assembly, and practically no reworks.

Interchangeable parts greatly simplify replacement problems. Inventory is at an irreducible minimum, service problems are negligible, and users are happy with the minimum maintenance and maximum performance of the pumps.

Write for The Cessna Story and Precisionaire Catalog SPG-160. The Sheffield Corporation, Dayton 1, Ohio.

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WASHINGTON...

New tax incentives . . .

Tax incentives to increase spending on plant and equipment seem certain to be passed by Congress this year. There are many reasons: The recession, primarily, and after that the attempt by Kennedy to exert leadership, which means putting the power of his office behind a recommendation in this field.

There has been much behind-the-scenes maneuvering as the administration goes about making up its mind as to precisely what kind of tax incentive it will recommend. In on the dickering are key Treasury officials (Secretary Dillon, Under-secretary Fowler, Tax Assistant Secretary Surrey), Commerce officials (Secretary Hodges), White House officials (Economic Adviser Heller, Budget Director Bell), Congressional leaders (Ways & Means Chairman Wilbur Mills).

Sentiment among the various industry groups won't crystallize until the administration settles on a recommendation of its own. In fact, representatives of scores of industries interested in tax incentives (accelerated amortization or whatever form it may take) agreed early in the game to delay pressing their own particular ideas until Kennedy recommendations had jelled.

The early leader . . .

At the outset it appears that the recommendation of the Kennedy task force on tax policy—headed by Harvard Professor Stanley S Surrey, who is now in the Treasury—has the inside track.

The report was never made public, but it did recommend that companies be given a deduction from their final tax bill based on the amount by which their capital spending for a year exceeds their depreciation allowances for that year (*AM/MM*—Dec 26 '60, p43).

Here's how it would work: Suppose a company spends $1 million on capital goods, and its depreciation allowance for the year is $800,000. It would be allowed to deduct—not from its income, but from its final tax payment—a percentage of the $200,000 difference.

The insiders were reporting, as *AM/MM* went to press, that the percentage to be applied might range around 10 to 20%.

What may be tied in with this proposal as an aid to small business is a proposal which would lift the present $10,000 ceiling on the current depreciation allowance given as a special first-year depreciation allowance. This now permits a company, regardless of other depreciation provisions, to write off an additional 20% of its plant and equipment spending the first year only; but the maximum deduction permitted now is $10,000.

Other early bills . . .

Other bills introduced provide a wide variety of methods to aid plant expansion and modernization. Among them: Senator Smathers has a bill which would permit companies to write off the entire cost of their plant and equipment in five years—in effect, a revival and broadening of the Korean fast tax writeoffs.

Congressman Patman's Bill would permit the expensing of any capital investment made in 1961 or 1962 up to $500,000 each year. His purpose is to help smaller firms more than larger ones, as his bill would obviously do.

Congressman Ikard, Congressman Curtis, and Senator Sparkman have a bill permitting a deduction from net income of the amount equal to a company's net addition to its aggregate capital.

Speed-up in defense orders . . .

The Pentagon, which has a traditional distaste for mixing defense business with economic pump-priming, is under orders from President Kennedy to review contracting plans for the next four months. The purpose: to see whether contract awards can be expedited so as to have an early effect on unemployment.

AFL-CIO dispute on free trade . . .

The AFL-CIO policy-making Executive Council is preparing a major statement reaffirming its free-trade position, for release at its Miami meeting later this month. This comes in the face of rising protectionist demands from affiliated unions hit by Japanese imports and unemployment. The IAM in California and IBEW in Illinois, for instance, have called for restrictions on imported tools (*AM/MM*—Feb 6 '60, p59) and electronic components, respectively.

But top federation leaders want to stem the rise in protectionist sentiment now being voiced, in varying degrees, by about a dozen unions. Top-level AFL-CIO strategy against foreign competition calls for (1) raising labor standards abroad, and (2) making domestic industries more competitive by automation, or to help sagging industries, with federal aid, convert to other work.

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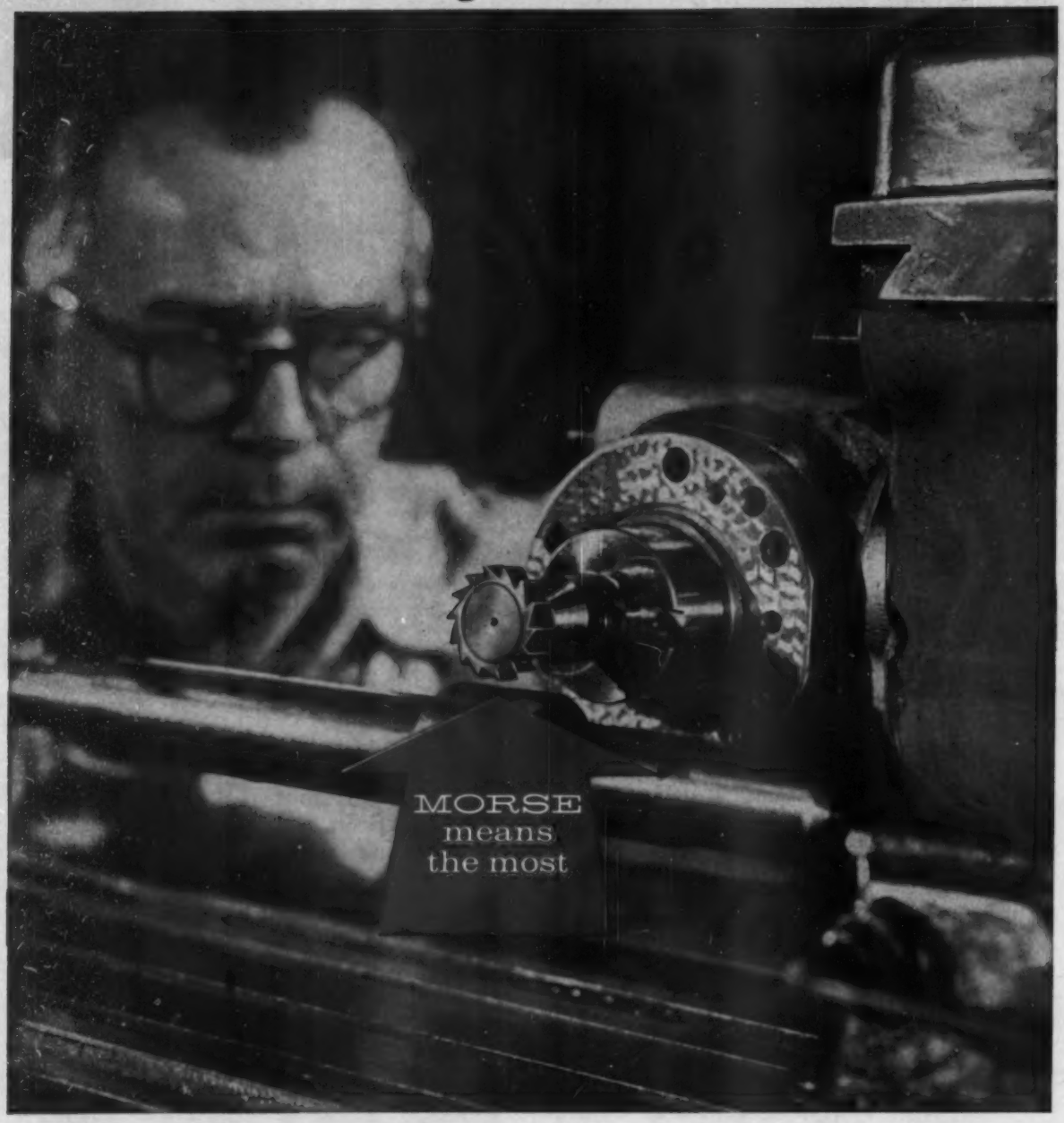

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DETROIT...

Further cuts . . .

With dealer inventories still hovering slightly above the uncomfortable total of 1,000,000, automakers have made further cuts in first quarter production schedules.

It is now unlikely that assemblies will exceed 1,300,000 units, compared to the 2,000,000 usually produced in this period. Weeklong shutdowns of the "inventory adjustment" type are chronic throughout the industry. Makes new to this problem, such as Pontiac, are appearing on the list.

Rambler sales slipped 10,000 units in January, forcing the company to temporarily suspend its widely ballyhooed customer-bonus payments. The slip also marks the first time in 40 consecutive months that sales did not exceed the like period of the year before.

A total of 75,000 auto workers put in a week or more of unwanted idleness during the month of February. This, coupled with parallel layoffs in supplier plants, leaves Detroit with 11.8% of its work force unemployed.

Auto profits . . .

1960, for the first year in many, shows all auto companies in the black. General Motors leads the parade with the highest dollar sales ($12.7 billion) in its history, but profits ($959 million) were slightly under the 1955 mark. Ford reported a 5.2% profit skid on a 2.2% sales drop. This directly reflects the lower profit potential in compact cars.

Studebaker will be in the black, but not by much. Chrysler will show a modest profit, and American Motors, on a non-calendar fiscal year, has already reported latest quarter earnings of $12.2 million on sales of $261.3 million.

Much is behind these balance sheets. Why, for example, can AMC make a fat profit on sales of between 300,000 and 500,000 cars annually, whereas Chrysler has in the past lost money selling twice as many?

The answer lies in overhead. In creative engineering alone, Chrysler employs 3500 persons, backed up by another 1700 in directly related service functions. AMC, on the other hand, puts out equally satisfactory vehicles with a total force of 25 creative engineers.

Chrysler has plunged into a "make" rather than "buy" program; AMC even in prosperity has never deviated from the paying principle that suppliers can satisfactorily perform a large percentage of the design function.

Now Chrysler, in a program headed by newly appointed administrative VP Lynn A. Townsend, is slicing a drastic swath through the ranks of its 30,800 salaried employees. It is part of the action necessary to reach a goal of making money on the production of 700,000 units annually. Chrysler, with nearly one salaried person to every two hourly workers, has the highest ratio by far in the industry. Even the already accomplished permanent cut of about 4500 persons plus attrition will not change this by much.

So the ax is still swinging. Advanced engineering and styling for 1964 models and beyond are practically at a standstill. This includes the turbine-engine development program.

Auto futures . . .

At a recent press conference, Studebaker President Sherwood Egbert cleared the air on future Larks. The 1962 Lark, size-wise, will be unchanged. It will have considerable, but not radical, styling changes. Egbert admitted a plan to put out a smaller car powered by a four-cylinder engine, but claimed it was not a "baby car."

Egbert said that engineering work would continue on the four-cylinder engine, but that no immediate use for it is contemplated. He plans an extensive series of dealer conferences before committing the company to radical new automotive concepts. He emphasized, however, that the company was in the auto business to stay.

At another press conference, Ford Division General Manager Lee A Iacocca intimated that press reports of soon forthcoming baby cars as well as models sized between the existing Falcon and Ford were well-founded.

AMC-Willys merger?

Though spokesmen for neither side will confirm (nor will they deny) that purchase of Willys Motors by AMC is in the offing, AMC officials currently parry such questions by referring to a project wherein their company and Willys will jointly manufacture an engine in Mexico.

Advantages to both sides are numerous. Parent Kaiser industries could use the estimated $80 million in cash that it would take to buy Willys. Willys could also make good use of AMC's strong chain of domestic dealerships. AMC, on the other hand, is thirsting for overseas assembly and distribution outlets, with which Willys is replete. It could also use a light farm truck line for its strong contingent of rural dealers.

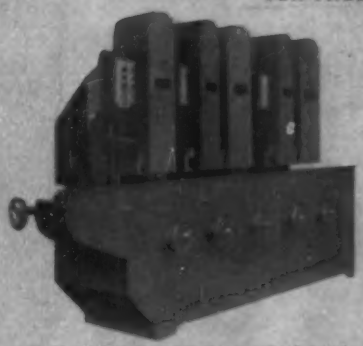
—Don MacDonald

BELT GRINDING: doubles production, improves quality on roughing and finishing operations!

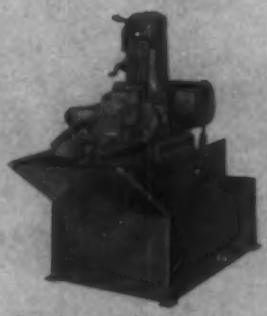
This Sundstrand-Engelberg two-head grinder has a tough job to do. Both sides of a flanged steel base plate require grinding — bottom side needs .002" stock removal, top side must have a uniform 15 microinch finish. The Model 680 belt grinder does the job, day in and day out, at the rate of 500 pieces an hour for the top side, and 475 for the bottom, doubling the speed of former methods. It uses a 120 grit — 320 grit aluminum oxide belt sequence.

You, too, may be able to drastically improve production and quality on your grinding operations. Send for literature and ask for a Sundstrand "Engineered Production" analysis of your final finishing operations to determine the economic benefits of abrasive belt grinding on your jobs.

OTHER TYPES OF SUNDSTRAND-ENGELBERG ABRASIVE BELT GRINDERS FOR PRODUCTION, MAINTENANCE, AND TOOLROOM WORK.



Multiple-head conveyer-type—rough grind to final polish in a single pass—any number of heads.



Centerless wet belt grinder—for stock 3/32" to 2-3/4"

Rotary table piston-type—operator loads and unloads without interrupting production.

CHECK THESE FEATURES OF ABRASIVE BELT GRINDING:

Greater production. Because of higher speeds, more grinding area, simpler setups, and no time lost for truing or wheel dressing, production is higher. Belts are sharper due to grain orientation. Flexing works out chips for better cutting edge exposure. Change-over time is reduced to a few minutes. Roughing and polishing can be done with only one setup.

• • •

More versatility. Any material can be machined: metallic or nonmetallic. They're efficient for either mass production, small lots, or toolmaking. They're more easily automated than many other machines.

• • •

Lower cost. Remarkable production lowers costs per piece. You don't need skilled labor for their operation nor elaborate, expensive fixtures. Belt grinders cost less to begin with than most other finishing machines. Also, belts are less expensive than wheels and are much easier to store and handle.

• • •

Simple and safe. Abrasive belt machining is safer because wheel hazards are eliminated. Operator fatigue is reduced and chips present no problems. Belts are easily changed by inexperienced personnel.

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AIRCRAFT and MISSILES...

TRENDS

A missile milestone . . .

The successful firing of the Air Force's solid-fueled Minuteman ICBM earlier this month marked a milestone in missile development.

The test was an unqualified success and cut months from the missile's development program. The Air Force now estimates that Minuteman will be operational by mid-1962—a full year ahead of the original schedule. See page 97.

The Minuteman missile was first conceived in 1957. But actual work on the program was not started until late in 1958, when it was put under control of the Air Force's Ballistic Missile Division. Minuteman's prime associate contractors are: Boeing Aircraft Company, for the launch control missile and test system operations; Thiokol Chemical Corp, for the first-stage engine; Aerojet-General Corp, for the second-stage engine and certain test operations; Hercules Powder Company, for the third-stage engine; Autonetics Division of North American Aviation, for guidance and control; and Avco Corp, for the nose cone.

Although final dispersement of Minuteman is still secret, unconfirmed reports are that some 1000 of the missiles will be put into underground silo launchers in the northern part of the U S and another 400-500 shuttled around the country in mobile railroad launchers.

Construction of the first Minuteman base at Malstrom Air Force Base, Great Falls, Montana, will begin in March, with some 150 silos built over the next 18 months or so. Ellsworth AFB at Rapid City, South Dakota, has been selected for a second Minuteman base and the Air Force is currently studying Pease AFB at Portsmouth, New Hampshire, for a third site.

Assembly of the Minuteman missile will be done at Hill Air Force Base, Ogden, Utah. Hill AFB will also serve as the control center for one or more of the mobile rail units.

Is there a missile lag?

According to reports coming out now, the crash production program once predicted for Soviet missile production has not materialized. Admittedly, both sides have only a handful of ICBMs ready for combat firing at present—best estimates are about a dozen Atlas missiles and 32 Polaris submarine-launched missiles are now in the U S arsenal. And, the U S is adding another 16-missile, nuclear-powered submarine to its Polaris fleet about every three to four months.

There are no figures available on the Russian missile tally, but presumably it is about on the same order as ours.

The "missile gap" study is expected to be completed by about February 20. Speculation is that the report will play a dominant role in any revisions that may be proposed in the defense budget by President Kennedy for the coming year. Already, Kennedy has indicated that some missile programs—Polaris and Minuteman—may be stepped up.

The Navy will begin construction of five additional nuclear subs. Original schedules called for five vessel starts this fiscal year. Cost of the extra vessels will run to some $500 million, with much of the funding coming from other shipbuilding accounts. Decision still to be made is whether the Polaris program will continue on an annual schedule of 10 vessel starts.

Increase in the airlift program calls for production of 30 Boeing C-135 jet transport planes (deliveries to begin in June 1961 at rate of two a month) and 23 additional Lockheed C-130E turboprop aircraft. Cost of the extra planes will run to $170 million. Original schedules for this year included orders for 50 C-130E planes.

Polaris problems . . .

The Navy is having trouble with its second-generation, A-2, Polaris missile. After three partially successful test firings, its fourth test missile blew up on the launch pad recently. And, so far, the Navy doesn't know what went wrong.

The A-2 missile is designed to extend the range of the Polaris from 1,200 nautical miles to 1,500. To increase the range, some 30 inches were added to the length of the 28-foot-long A-1 model. The 54-inch diameter of the missile remains the same, however.

The A-2 version of the Polaris is slated to go into service in early 1962. But, so far, the Navy has only been able to achieve a range of some 1,400 miles in its testing. The A-2 will also be superseded in the next two to three years with a 2,500-mile A-3 model. It will have the same dimensions as the A-2, however. Because of the longer length of the follow-on missiles, the Navy will have to modify its first five Polaris submarines, built to handle the A-1 missile.

Two of the Polaris submarines are on station, with a third due to join the fleet any day. All five of the initial Polaris submarine series will be in operation before the end of 1961.

TALK ABOUT ABILITY!

This husky boasts a 100 hp main drive motor and spindle speed range of 6 to 750 rpm. Its massive 7½" tailstock spindle offers big load capacity. Pre-selective hydraulic powershift and push button control of cross and longitudinal feeds keep this giant under fingertip control. 48 spindle speeds provide any surface speed with a deviation of less than 6% from that actually required for the chosen diameter. The operator, after setting the correct surface speed, merely dials the work diameter. The computing dials then automatically produce the correct rpm for each diameter. Or . . . the operator may choose rpm directly if he wishes. Write for Bulletin 913-A.

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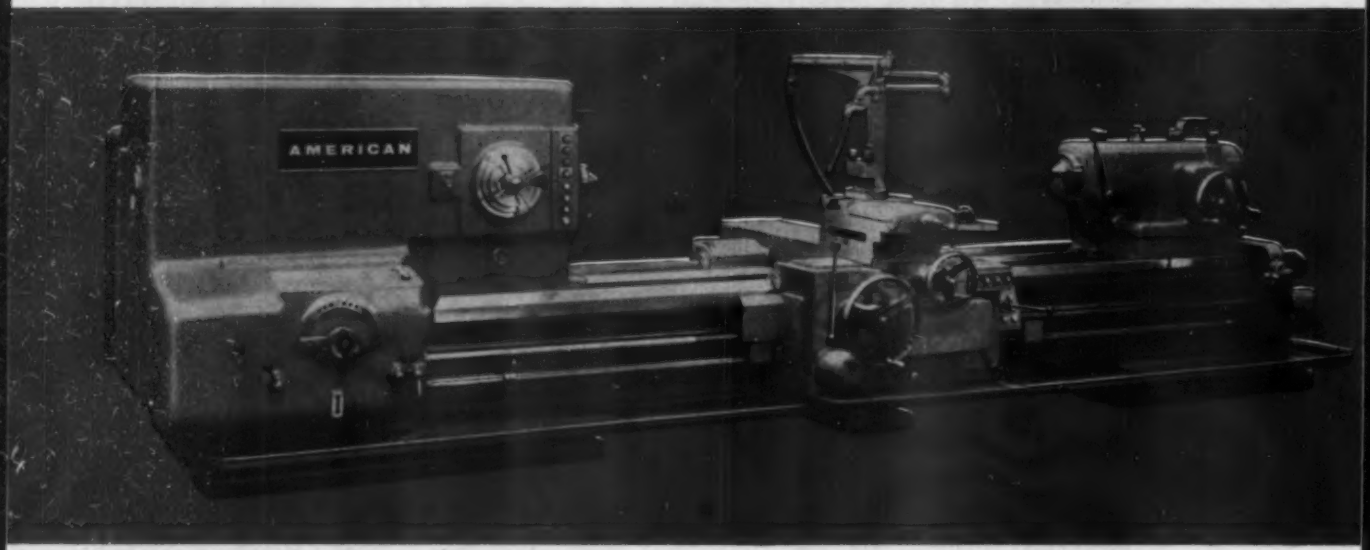

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MACHINE TOOLS... TRENDS

Licenses for Russia reinstated . . .

Jones & Lamson Machine Co and Bryant Chucking Grinder Co have had their licenses reinstated for shipment of grinding machines, valued at about $2 million, to Russia. Both companies were well along in manufacture of the machines when the licenses were suspended late in December.

The reinstatement occurred after a session on the subject with the Internal Security Subcommittee of the Senate Judiciary Committee. The crisis is believed to have been precipitated by people in the miniature bearing industry who protested to Washington the shipment of U S machines to Moscow.

The policy about shipments to Russia now is back where it was before the license suspension occurred. The Commerce Department's program of granting licenses on the merits of individual applications has been sustained.

The feeling is that the Kennedy administration's attitude will be reasonably liberal toward Soviet trade, but obviously the Positive (forbidden) List will continue to be in force.

Some licenses, including that of the Cross Co, have not yet resulted in any business being placed, although they were granted some time ago. The delay is attributable, in part, to the Russians wanting to be assured of their ability to die cast an aluminum engine that is at the heart of a big automotive tooling program.

Dutch agency represents Soviet . . .

A number of prominent U S builders have been in Russia recently in connection with pending orders.

They have gone there on invitation of a Netherlands trading agency which has been doing business with Stankoimport and other Soviet government bureaus. This agency is known in this country as Primary International Inc, with offices at 120 Wall Street, New York City.

The agency is reported to have sold Russian goods in world markets and thereby accumulated gold that is used to buy U S machine tools and other products that the Russians want.

Three different methods of payment are being used in dealing with U S companies. One is payment of one-third down when the order is placed, with the remainder consisting of a series of progress payments every 30 days.

A second method is to make payment when machines are delivered to the docks in this country for shipment overseas. A third is to withhold payment until machines reach Amsterdam for transshipment to Russia. Up to now, no U S builder is reported to have been willing to accept the third method.

U S builders find that when they get to Moscow they may wait several days or even longer before they have a chance to present their case. Then they appear before a sizable group of Russians, including engineers from ENIMS, the government research department whose business is to evaluate the performance and worth of every type of machine before an order is placed.

Falcon engine for Australia . . .

Automotive orders and prospective orders from abroad are the greatest single source of interest currently to U S machine tool builders.

Ford is said to have plans for making its Falcon, including the engine, in Australia. The Falcon has been a roaring success Down Under and Ford is keen about giving General Motors' Holden a run for its money. Machines for the engine production line probably will be bought at Dearborn, but British builders may get a big share of the business because of their tariff advantages inside the Commonwealth.

The delivery problem just might upset this idea, however, unless British builders are able to make much better deliveries than now appears probable. Under such circumstances, U S builders would get more of the business than otherwise.

Ford to expand in Argentina . . .

Ford is to manufacture a truck in Argentina, following in the wake of General Motors. General Motors is constructing a line there for a truck of Vauxhall (British) design. It began to buy British for this job. But the delivery situation became so sticky that it ended up placing a substantial portion of its machine tool requirements with U S builders. Same thing may happen at Ford.

Ford still is in the midst of its big expansion at Cologne, Germany, for which many U S machinery builders are providing machines.

There have been no cancellations of big automotive expansion programs in Europe, despite the recession that has hit the motor car people there.

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MATERIALS... TRENDS

Delrin has a birthday . . .

Following 12 years, and $50 million, of research and development, Du Pont's Polychemicals Dept put Delrin on the market in January 1960. Prior to this debut, several hundred companies tested this unique acetal resin. It offered a variety of metal-like properties—and went on the market at 95 cents a pound. Reductions of seven and eight cents a pound, respectively, were made on Feb. 1, '60 and June 1, '60.

March 7, '61 will see another reduction—to 65 cents a pound. Thus the price is reduced about one-third in 14 months. Although Du Pont could not be induced to give its 1960 sales volume, estimates of several million pounds might be conservative. About one-quarter of the volume was used overseas. Du Pont spokesmen feel that a 10-fold increase in 1960 volume by 1963 is not unlikely. The major price move is to accelerate this acceptance. More than 500 different Delrin products are being manufactured in the U S today, and more than 200 are produced abroad. One of the outstanding applications is the Chrysler Valiant two-pound instrument housing.

Representing a new concept in thermoplastic engineering materials, this acetal resin is a highly crystalline, stable form of polymerized formaldehyde. Its combination of properties bridges the gap between metals and plastics. Industries using the material include automotive, petroleum, machinery, hardware, toy, packaging, plumbing, and building. In some 82% of present applications, it is replacing metal—primarily nonferrous metal such as zinc, brass, and aluminum.

Soldering aluminum . . .

Joining aluminum and its alloys by soldering no longer is the problem it once was. However, corrosion still is a major detriment to soldering. The more critical the corrosive environment, the less favorable is the chance of satisfactory soldering. With a flux powerful enough to break up, or prevent, aluminum's tough surface oxide, ordinary lead-zinc or tin-zinc solder will work very well.

For "soft soldering" below 500 F, solders high in lead or tin can be used. Though somewhat more expensive, tin is better because it will readily wet aluminum. Lead and aluminum are not as compatible. When the proper flux is used, pure zinc or zinc with about 5% aluminum is the best solder—strongest and least corrosive—but it must be applied at nearly 800 F. And 800 F is just about the top safe temperature for soldering aluminum and its alloys.

Two new "fluxless" solders have come to our attention within the last few weeks. One is called "Tin-A-Lum," the other "Chemalloy." The latter, manufactured by Chemalloy Electronics Corp, Santee, California, is a lead-zinc alloy said to be capable of soldering aluminum, copper, brass, diecast, and aluminized—galvanized—or copperized—foils and solids. Homogenizing the alloy is described as the reason no flux or other metal preparation is necessary.

Tin-A-Lum was developed in England and came to the U S via South Africa. It is sold here through Metals for Industry, Inc, Jersey City, NJ. This alloy is homogenized zinc and tin, which melts at 410 F and solders without flux. It is said to be capable of joining aluminum and its alloys, zinc, tin, pewter, magnesium, and other nonferrous metals, as well as stainless steel and other ferrous alloys.

At a demonstration in New York City, Tin-A-Lum's inventor, G P Strike, made the solder look surprisingly capable and easy to use. Testing laboratories, including the South African Bureau of Standards, Messrs Sandberg of London and the United States Testing Co, Hoboken, NJ, report that samples of soldered aluminum showed approximately 20,000-psi tensile strength at the lap joint. Failure occurred next to the joint.

Corrosion resistance . . .

Salt-spray corrosion tests, providing 48-hr exposure to a 5% sodium chloride solution, showed more corrosion of the aluminum sheet than of the soldered lap joint. (We understand from other sources that a 250-hr exposure is the minimum considered adequate. This duration probably would have consumed the Al sheet). However, the unanswered question is how much the corrosion process was accelerated by the electrochemical couple. Would a solid sheet of aluminum corrode as rapidly?

Soldering by iron, torch, or dip methods is possible with these materials—and the manufacturers say that holding the solder molten in a pot improves its properties. Other metals joined include tantalum, titanium, and Inconel.

All the problems aren't solved by these improved solders, but the real significance is that they do open some new fields for using aluminum, and magnesium, and they can simplify some manufacturing methods.

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WHAT'S AHEAD... in Metalworking

TRENDS

Still in a sideslip...

With metalworking production running in neutral gear, as it has been for several months, the tendency is to grasp at any straw in the wind that offers some indication as to when the long-awaited upturn will come.

One indication that metalworking may begin its upcurve in the spring is a report by the nation's steelmakers that orders are beginning to pick up from a variety of small industries.

Also showing signs of emergence from a long sleep is the farm equipment industry, which is beginning to cut into top-heavy dealer inventories. Industry sources report two prime reasons for this: rising farm income, and the fact that farmers who delayed replacing equipment last spring because of extremely bad weather can't put it off much longer.

Construction machinery industry, spurred by expected road expenditures under the Kennedy administration, now has its inventories at distributor levels pretty well in hand, and a definite business upturn is expected in the second quarter. As a result, 1961 should show a fair improvement over 1960.

All in all, the steel situation is materializing just about as producers expected—though not as they had hoped. Small industry ordering, plus improvements in farm implement construction and some other seasonal industries should put March steel output slightly over present levels. Otherwise, all steel products remain in abundant supply.

Prices show no indication of moving up. There is as yet no increase in steel production rates.

A look at other barometer industries:

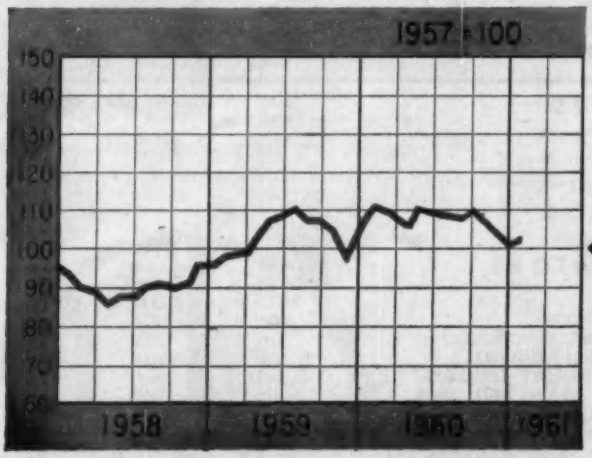
- **Cutting tool manufacturers** are showing cautious optimism, even though no real upturn is expected before, say, June. Meanwhile, sales are increasing slowly but steadly.
- **Small and fractional horsepower motor** manufacturers, while they report a mixed bag of orders at the moment, are fairly well agreed that the second quarter should run about 5% ahead of the first.

Mill supply houses, by contrast with cutting toolmakers, are exhibiting cautious negativism. In other words, as one put it, "We're in a consistent rut. We are not concerned, but we are not particularly happy, either." Mill supply men generally see nothing ahead for several months but a steady, even somewhat lower, volume of business.

Screw machine products manufacturers, who chalked up their worst month of 1960 in December, now forecast that 1961 will see a decline of 10 to 15% in shipments from 1960 levels.

Plastic molding shops, too, peg overall business as static, with industrial and durable goods orders in an especially bad way. Holding up well, however, are housewares and certain proprietary items. Several molders are tooling up for new jobs but no one expects business improvement before June at the very earliest.

Commercial heat treaters, on the other hand, report some increase in activity in the early weeks of the year, and are confident of a month-to-month pickup for the rest of '61, with a slightly bigger increase to come in the second half.



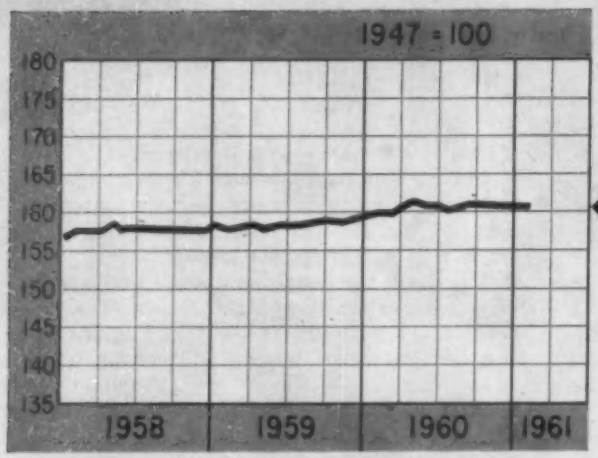
100

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	JAN Estimated	DEC Preliminary	NOV Revised	DEC Year Ago
Total Index	**100**	**99**	**101**	**103**
Machinery		**95**	**98**	**104**
Electrical Machinery		**108**	**108**	**116**
Autos		**97**	**103**	**94**
Other Transportation ..		**89**	**90**	**91**
Other Metalworking ...		**104**	**106**	**107**

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JAN Estimated	DEC Preliminary	NOV Revised	DEC Year Ago
Total Index	**160.2**	**159.9**	**159.7**	**159.6**
Metalworking Machinery	194.8	194.5	189.7	
Other Machinery exc. Electrical	173.4	173.6	172.3	
Electrical Machinery	158.8	158.8	162.1	
Fabricated Metal Products	148.0	147.6	148.1	

The new administration and housing...

President Kennedy has announced measures designed to prop up sagging segments of the economy. Some of his key recommendations are intended to spur the housing industry out of the doldrums it has exhibited in recent months.

He has taken steps to reduce the cost of borrowing to finance home construction, and he has acted to speed urban renewal projects in blighted areas of our major cities.

Any increase in housing construction activity that these moves produce will be an important aid in boosting general business activity.

But don't expect instantaneous results from these efforts. Past experience clearly suggests that attempts to temper business activity by regulating home construction do not promptly succeed. ceed.

In 1956, for example, Congress adopted programs to stimulate special housing categories. But many months elapsed before housing starts rose significantly in these areas. Similarly, a decision by the preceding administration to reduce home construction volume during the 1955 business boom produced the desired result only tardily.

Although the administration can effectively increase the volume of money available to the homebuilding industry, it cannot be sure that builders will be ready to step up their construction activities.

Builders encounter many delays when attempting to expand their operations. Finding needed financing is a time-consuming task even when Washington is encouraging new building. Then, too, builders must recruit work crews and prepare sites to begin new projects. And urban renewal activities similarly face delays.

The President's recent actions thus may not produce as quick a pickup in new housing construction activity as is desired. Still, they appear to indicate that the slump in homebuilding gradually will reverse, and that home construction will be boosting rather than retarding general business activity as 1961 progresses.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949 = 100)*	144.3	144.2	159.4
Steel ingot operations (thousands of tons)	1,492	1,466	2,683
Electric power output (million Kilowatt hours)	15,072	15,361	14,094
Production of automobiles	101,558	96,057	164,027
Engineering construction awards (Eng. News-Record—thousands)	286,970	346,399	374,798

QUARTERLY BUSINESS INDICATORS	Latest Quarter	Preceding Quarter	Year Ago
Gross National Product (billions)	503.5	505.0	481.4
Expenditures of new plant and equipment (millions)	35.9	36.3	33.3
Profits after taxes in primary iron and steel industry (millions)	132	263	—89
Profits after taxes electrical machinery industry (millions)	250	265	301
Profits after taxes in motor vehicles and parts industry (millions)	191	504	233
Motors and generators new orders index (1947-1949 = 100)	176	180	190
*Seasonally adjusted			
Profits after taxes machinery (except electrical) (millions)	231	319	335

What?

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For 20 years we have been making this automation machinery to produce our own light bulbs, radio tubes, fine electronics equipment. No one has ever equaled Sylvania automation machinery for accuracy and long-term dependability.

Now these machines are available to outside companies seeking this same extraordinary degree of accuracy.

Ideal for high-speed automatic fabricating, finishing, assembling, indexing, packaging, these machines are available in two general types:

1. Conveyor indexing chassis, exceptional for the extreme accuracy, strength, and versatility of its chain—not made commercially, but by Sylvania itself. Chassis also provides greater tool and driving capacity than other such chassis on the market.

2. Rotary indexing chassis in two sizes and in single and double turret models. Made with unusually great driving and tool capacity. Top of the transmission spider is specially machined for rotary vacuum or pressure valve.

Also, precision indexing transmissions (5 models)

- **Heavy-duty unit** with extra-large cam well and spider diameter for wider range of stops per revolution.
- **Standard unit** features higher cam speeds, a provision to integrally mount rotary vacuum or pressure valves.
- **Universal unit** operates with its output shaft horizontal or vertical. Has wide range of applications.
- **Small universal unit.** Lower silhouette and extra-long input shaft are main features of this extremely durable, accurate transmission.
- **Conveyor unit.** Very rugged, heavy-duty unit designed for conveyors, but easily adaptable for rotary tables, other intermittent motion machines.

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PRINCIPAL FEATURES

- **Two dial indicators (.0002″ graduations) are provided, one for each side of the tooth being checked.**
- **With opposed indicators, instrument set-up is quickly verified by checking the work with one, reversing it and making a comparative check at the same point with the other.**
- **A protractor on the contact finger holder assures proper helix setting. This is pivoted to swing through 180° in order to check both sides of the tooth without angular adjustment.**
- **Work is mounted on ball bushings to minimize the effect of eccentricity.**
- **A self-disengaging spindle lock secures spindle while base circle disc is being mounted.**
- **Indicating slide is mounted on rollers to avoid brinelling or grooving the ways.**
- **Indicating slide is driven by a self-locking gear mechanism to prevent the slide from running free.**
- **Work slide is carried on box ways for better control.**

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Bold Action on the New Frontier

More than at any other time in memory, Washington appears eager to enact legislation to spur spending for new plant and equipment.

The wish begins in the White House itself. President Kennedy, in his Economic Message to Congress, said that "expansion and modernization of the nation's production plant is essential to accelerate economic growth and to improve the international competitive position of American industry."

Knowledgeable . . .

about the situation confronting industry, the President asserted that "embodying modern research and technology in new facilities will advance productivity, reduce cost and market new products."

Mr Kennedy summed up the feelings of many of us when he declared that "an early stimulus to business investment will promote recovery and increase employment."

These views, expressed so forthrightly, are shared with the President by members of Congress. A number of bills already have been introduced with the purpose of accomplishing Mr Kennedy's objective.

Congressman Wright Patman, in his bill, would allow a company to write off immediately any capital investment made in 1961 or 1962 up to half a million dollars a year. The bill's chief aim is to aid small business firms.

In another bill . . .

Senator Smathers would allow companies to write off the entire cost of new plant and equipment in five years. This proposal is akin to the plan that was in force during the Korean war.

Still other bills have been introduced, all with an identical purpose of stimulating capital spending and thereby getting the national economy off dead center. So, in this maze of activity, what is likely to happen?

The President has given a strong hint, without spelling out details. He expects to propose a "modification of the income tax laws to provide additional incentives for investment in plant and equipment."

What Mr Kennedy almost surely intends is to endorse the recommendation of his Assistant Secretary of the Treasury Stanley Surrey that a tax credit be given every company which makes a substantial outlay for new plant and equipment.

A firm's final tax bill, as explained on this page once before, would be lowered if its capital spending during the year exceeded its depreciation allowance. A percentage of the difference would be credited against taxes.

This proposal may not be . . .

the world's best. But it has obvious virtues. One is its simplicity. It is not tied in with complicated calculations. Any management can figure out quickly exactly what its tax saving would be if it invested in plant and equipment.

With the least possible delay, Congress should enact this plan into law. But let's not fool ourselves into believing that merely putting the law on the books will necessarily be a sufficient stimulant. The allowable percentage of saving will be the critical factor. Determination of the percentage presumably will be within the authority of the Treasury.

To jolt the economy into action, and that means to get firms to invest their funds, the percentage must be high. The incentive must be strong and tempting. Otherwise the plan will fail from the beginning. This is the time for bold action on the New Frontier.

Burnham Finney EDITOR

Threaded in just 6 seconds on a Gisholt CRI-DAN

Here's a good example of what you can do on a Gisholt CRI-DAN Threading Lathe—an internal thread, 2 3/16" diameter x 1/4" long, 12 t.p.i., cut in a phosphor-bronze bearing housing in just six seconds.

Speed and versatility obsolete other methods.

Note the other jobs shown—the variety of work and the fast threading times. Simple on a CRI-DAN—yet, each presented problems that could only be solved at high cost using any other method.

It's Cri-Dan for highest quality, lowest cost.

The jobs shown here prove that close tolerance and high-quality finish requirements are met easily on the CRI-DAN. The CRI-DAN method, using an inexpensive single-point carbide tool, is faster and less costly than thread grinding or thread milling.

20 seconds—Zoom operating sleeve for movie camera; aluminum; I.D. pilot dia. bored; tool indexed for threading a 2-start, .0625-pitch, .125"-lead, Class 4 16NS thread in the 1.610" center section.

15 seconds—spinning roller; stainless steel; 18 t.p.i. thread on 5/8" diameter for 3/8" length.

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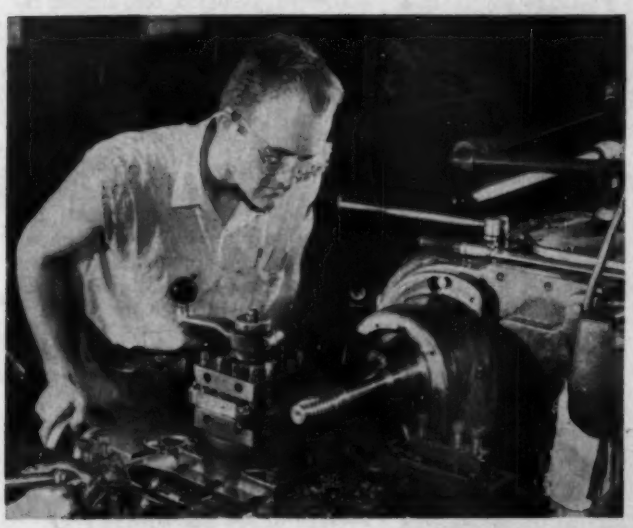
VOL 105, NO 4 **American Machinist** / *Metalworking Manufacturing* FEB 20, 1961

STOP...
babying cutting tools!

Here are two articles implementing a not-so-new theory—that kid-glove treatment of cutting tools is false economy of the worst kind, particularly in today's high-production setups



THE CASE FOR THROWAWAY CARBIDE BITS

"Slow down a machine tool costing $30,000 to $50,000 or even more just to conserve a cutting edge worth 20¢ to 50¢? False economy, certainly . . ."

FOR A DOWN-TO-EARTH APPLICATION OF THIS THEORY, SEE NEXT PAGE

HOW TO CUT BANDSAWING COSTS

"The most economical cutting rate is that which achieves the highest speed without any sacrifice in needed accuracy. Something has to give, and in this case it is band life."

THIS NEW APPROACH TO BANDSAWING ECONOMY BEGINS ON PAGE 94

Stop babying cutting tools!

The case for throwaway carbide bits

"Our experience has proven that babying cutting tools to achieve longest possible life between regrinds is false economy . . . gives competitors with efficient plants and procedures a cost advantage"

By Leonard A Wickstrom, chief industrial engineer
Denver Division, Gardner-Denver Co

Slow down a machine tool costing $30,000 to $50,000 or even more just to conserve a cutting edge worth 20¢ to 50¢? False economy, certainly. Production rates are slowed, and manufacturing costs aren't distributed over the greatest possible number of pieces—a sure way to give competition a cost advantage.

For this reason, many plants now find it profitable to turn and mill with carbide bits at speeds and feeds which wear down cutting edges in 30 minutes or less actual cutting time (AM—Apr 6 '59, p117).

Gardner-Denver has chalked up cost reductions of 50% to 75% in steel turning and face-milling operations, and has achieved similar reductions in cost-per-cutting-edge for single-point carbide-tipped tools.

This has been done by shifting wherever possible from brazed-tip tools to throwaway carbide bits in clamp-type holders, and by using these tools at the most economic cutting speeds and feeds.

If the machine has sufficient capacity, and the work can withstand increased cutting pressures, Gardner-Denver selects cutting speeds and feeds that result in an average cutting edge life of 10 minutes or even less.

Costs cut 50 to 75%

As a result, job costs have been cut 50% to 75%, even though the carbide toolbits cost more.

But this is only part of the savings that have been achieved at Gardner-Denver by conversion wherever possible from brazed-tip carbide, single-point tools to indexable throwaway carbide bits in clamp holders. Tool cost per cutting edge has been cut more than 50%, even though reduced volume has boosted the cost of resharpening such brazed-tip tools as are still needed.

Average cost per single-point carbide cutting edge delivered to the shop has been cut from 81¢ in 1956 (the last year when we used brazed-tip tools exclusively) to 37¢ in 1959.

These costs include all expenses involved in maintaining sharp cutting edges on all carbide-tipped single-point tools issued to the shop —whether new, retipped, or resharpened. Included, too, are all resharpening costs, expenses incurred in retipping or replacing damaged or broken brazed-tip tools and (since 1956) replacement of damaged or worn out throwaway bits and their clamp holders.

Gardner-Denver, which has been using carbide-tipped single-point tools since before World War II, has in the years since developed an efficient carbide tool maintenance program—one that minimizes tool cost per cutting edge.

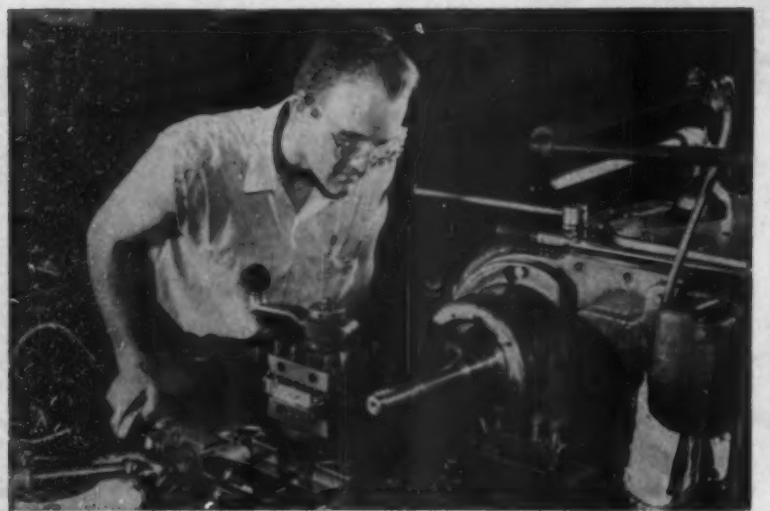
Edge maintenance cheaper

For instance, by 1956 the company's carbide tool specialists had achieved an average cutting edge maintenance cost of 81¢ for brazed-tip cutting edges issued to the shop, compared with an estimated industry average of 95¢ per cutting edge.

Because turret lathe and other operations with brazed-tip single-point carbide tools were programmed for one tool change per eight-hour shift, cutting speeds were held to between 250 and 500 fpm in turning steel. Included in estimates of operating costs was 10¢ (one eighth of the 80¢ average cost per edge for several years) per hour for each single-point tool used.

At the time, Gardner-Denver considered this a reasonable tooling charge, so much so that it delayed serious consideration of clamp-held carbide bits for some time.

It was not until late in 1956 that representatives of the Kennemetal Co persuaded Gardner-Denver management to give indexable-bit carbide tools a trial. Actual shop



Cost of turning these steel valve stems was cut 60% when indexable carbide bits were substituted for brazed-tip tools. Cutting speed was boosted from 290 fpm to 600 fpm (highest available), and tool life per edge was cut from 78 to 15.9 minutes. Total cost per piece, including tooling, was cut from 37.5¢ to 14.7¢

comparison tests were to be preceded by training courses for shop supervisors, methods men and engineers.

This program started January 1, 1957. Admittedly, the cost of maintaining sharp cutting edges on brazed-tip tools climbed from 81¢ per edge in 1956 to $1.26 in 1959, but at the same time increased use of indexable throwaway carbide bits in clamp holders (at an average overall cost of only 23¢ per cutting edge) cut the average cost per edge to 37¢ by 1959.

Whereas 24,103 cutting edges were issued in 1956, 38,537 were issued in 1959, including 5422 brazed-tip tools and 33,115 cutting edges on throwaway carbide bits. Had brazed-tip tools still been used exclusively in 1959, single-point tool costs would have been $31,214.57 instead of the $14,258.69 actually spent.

Early in the program, Gardner-Denver bought a GE machinability computer to aid in the correct application of indexable throwaway carbide bits. After a few trial runs on the computer, it became evident that during an eight-hour shift a single-point tool in a turret lathe setup actually cuts metal for only about two hours.

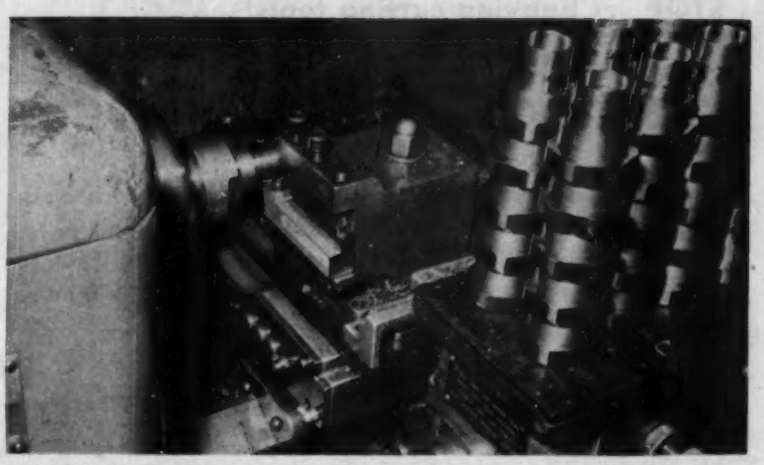
10 to 1 favor of throwaways

Taking the old cost of 10¢ an hour as a basis for comparison, and an average cost per cutting edge of 9.5¢ for indexable carbide bits—which on the same basis gives a cost per hour of only 1.2¢—the company found a cost ratio of a little less than 10 to 1 in favor of throwaways.

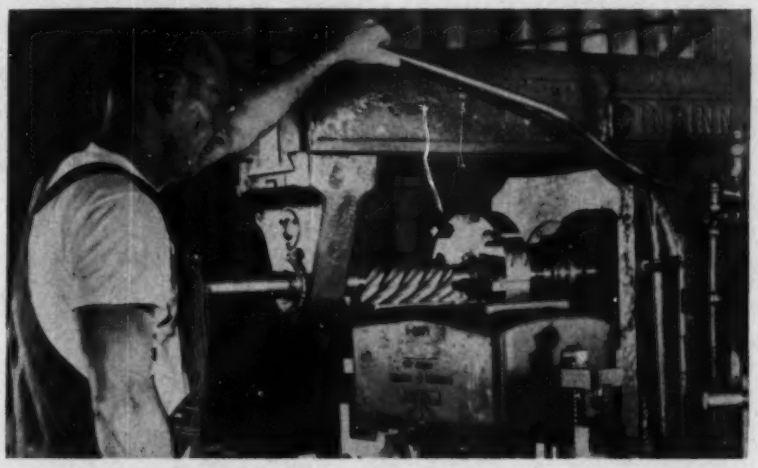
Because the cutting tool is in contact with the work for only about one-fourth the time in an eight-hour shift, Gardner-Denver concluded it could afford a tool cost of 1.2¢ per minute, or 60 times the tool cost per hour estimated on the old basis. For that reason, the company began to work toward a 10-minute average tool life per cutting edge.

Using the computer on this basis, Gardner-Denver found that it should cut most workpieces at 700 to 1000 fpm, and in some cases at 1200 fpm, instead of the former 250 to 500 fpm cutting speeds.

At the time, these speeds seemed unreasonably high, but the company was willing to give the computer an honest trial. To everyone's surprise, the higher cutting speeds proved satisfactory in practically all cases—if the machine's capacity was adequate and the work could withstand the increased cutting pressures.



Tool cost per piece was cut 92% when Grade K7H Kendex carbide inserts in negative-rake holders were substituted for positive-rake, brazed-tip carbide threading tools for chasing 2.122-16 NS threads on SAE 8720 steel guide bushings in a Sentinel Cri-Dan Model B automatic threading lathe. Cutting speed was increased from 290 to 442 fpm



A five-minute tool life was justified for the eight Kendex throwaway inserts in the 10-in. OD, 8-tooth face-milling flycutter in this combination setup with a 3⅜-in. OD HSS slab mill for facing two bottom pads and two side pads on CI gear housings. Change from HSS cutters in both positions boosted production 31 parts per shift and cut tool cost per part from 66¢ to 11.4¢, a saving of 54.6¢ per part

There were, however, instances in which the limits of the setup were exceeded, and it was necessary to calculate for a tool average of up to 30 minutes. In other cases, when the tool was in contact with the work only for a short period, the setup rigid and power adequate, a five-minute average tool life proved more economical.

The computer also helped get the program under way by serving as an arbitrator in disputes over cutting speeds and feeds for a given operation. Complaining operators were invited to prove the computer wrong, but almost invariably it was right—when actual conditions were the same as those programmed on the computer.

By throwing traditional concepts of tool life to the winds, Gardner-Denver has achieved astounding savings in tool life costs, and tool cutting edge cost per piece has been cut materially in some applications. Admittedly, in some instances tool cost per part is increased, but this is counterbalanced by a higher metal removal rate and a consequent increase in speed of production. Above all, total cost per piece has been cut drastically in almost every operation by not babying tools. •

STOP . . . babying cutting tools!

How to cut bandsawing costs

Most economical bandsaw cutting rate is *not* achieved by kid-glove treatment of blades (which only amount to 10% of total cutoff cost), but rather by finding the top speed at which accuracy can be maintained. Here is how

By Charles Cleland, project engineer
Continental Machines Inc, Savage, Minn

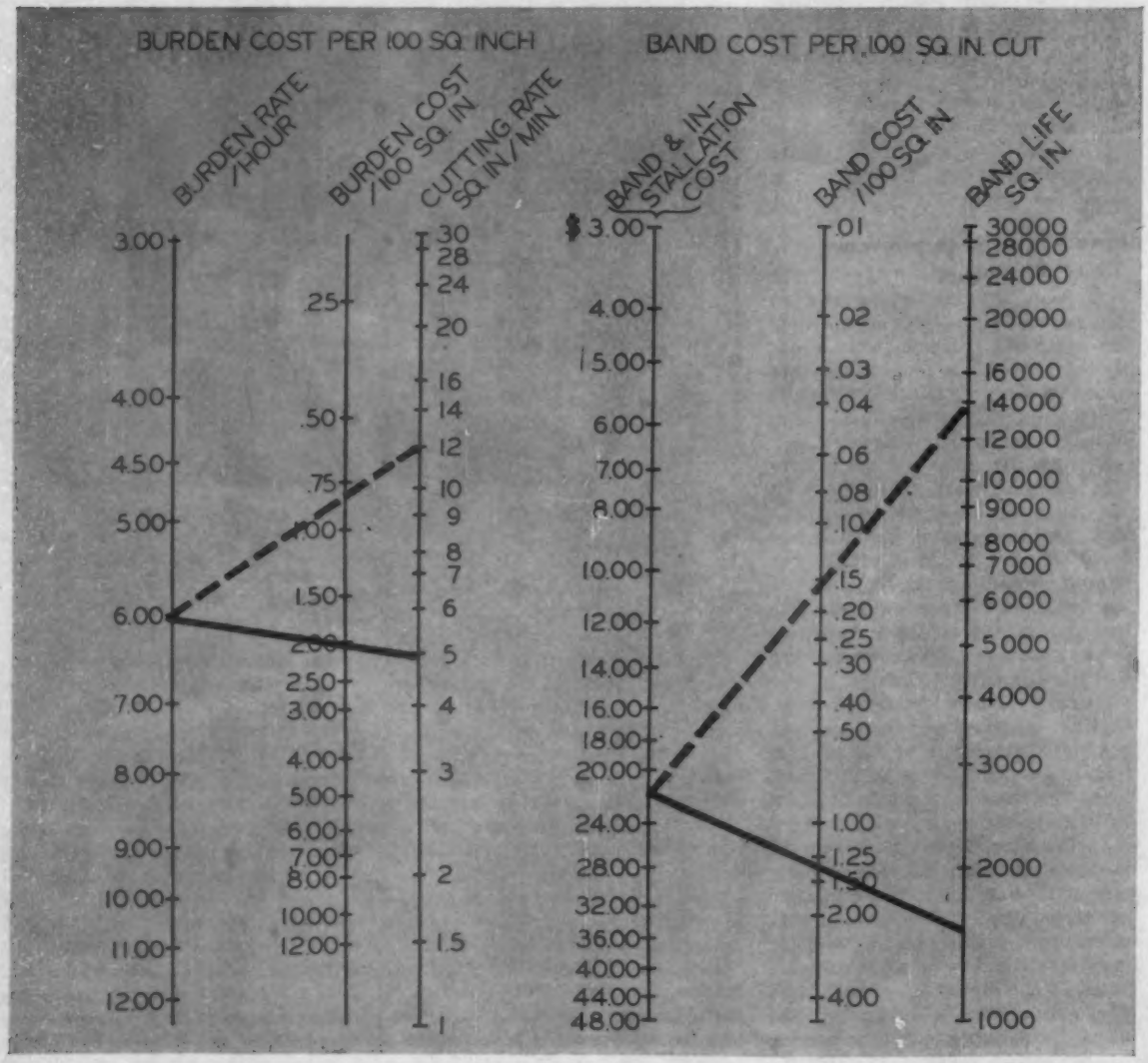
Cost of doing business with a bandsaw depends upon three things: blade life, cutting rate, and required accuracy. Improve any one of these factors and ground is lost on the other two. The most economical cutting rate is that which achieves the highest speed without any sacrifice in needed accuracy.

Something has to give, and in this case it is band life. But because band life is an easy cost to figure (invoices for new bands are merely saved and added up), and because production rates and actual cutting time per part are much less likely to be available to the average cutoff department, most shops tend to figure bandsawing in terms of band costs and to let it go at that.

But the cost of a saw band is only about 10% of total cutting cost, so even if bands were free, the cost of any operation would only be lowered by one-tenth.

On the other hand, some shops have saved as much as 40% of total cost by adjusting their cutting rates to a more efficient figure.

How can the maximum usable cut-



ting rate be determined for a job? First off, let us assume that a 1-inch HSS band is cutting a 6-inch mild steel bar. Three factors limit the usable cutting rate:

- Tooth load (the point beyond which teeth actually break)—this figure would be around 30 sq in./min.
- Tooth wear the (point beyond which band teeth wear excessively)—this would be about 16 square inches per minute.
- Beam strength of the band (which controls accuracy). Accuracy decreases as work size increases, also as feed pressure increases. Thus for the same sample, this limit would be somewhere around 12 square inches per minute.

In other words, no matter how much load or wear a band can take (30 sq in./min or 16 sq in./min, respectively), cutting in the final analysis is governed by the beam strength of the band—if it flexes too much, the cut will be inaccurate and the piece will be ruined or have to be reworked.

Figuring costs

In the table at lower right, three different cutting rates are listed, each maintaining the same cutting accuracy, and each rate attained on a 5-inch SAE 1020 bar stock with a 1 in x 0.035-in. HSS band. In all three cases, the cost of blade plus installation was $21, and the burden rate (labor plus overhead) was $6 an hour.

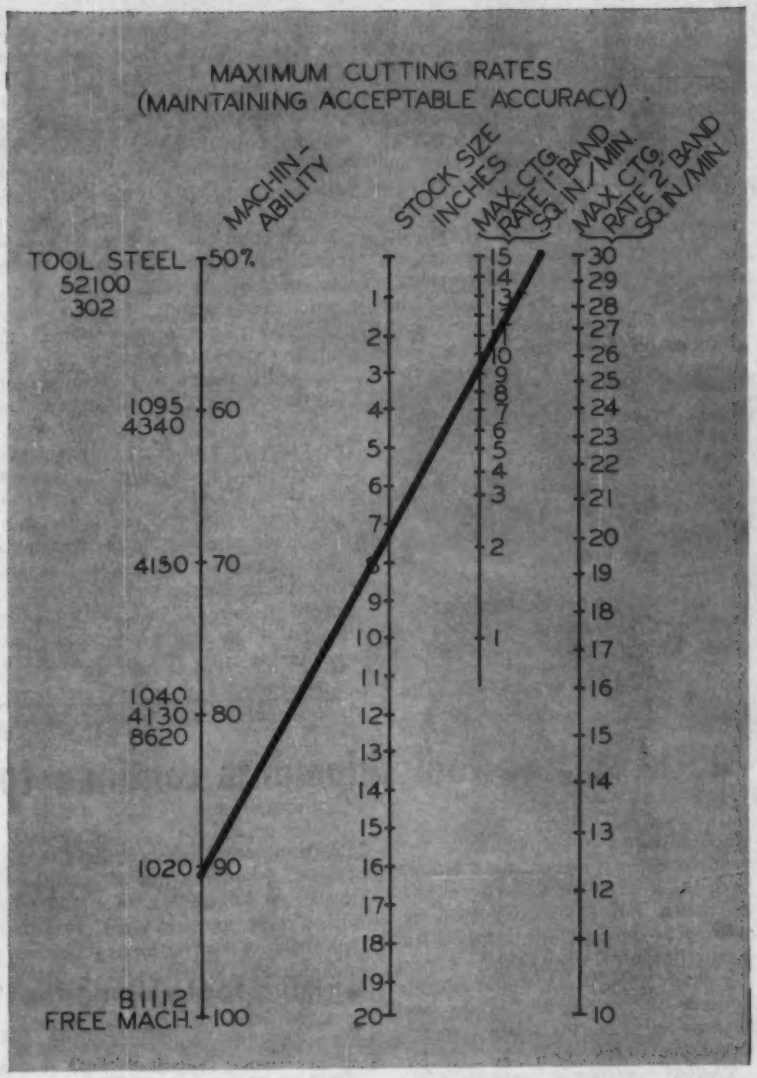
The cutting rates differ in the examples shown in the table—5, 10 and 12 square inches per minute. In "C" the total cost per 100 square inches is appreciably lower than in "A" and "B"—even though 1.4 times as many bands were required. To put it another way, higher cutting rates saved enough on labor and overhead to more than offset increased band cost.

Cutting conditions as shown at "A" are not uncommon, but those at "C" can only be attained with modern machines, a modern band . . . and the knowledge that band price and wear are not major cost factors. If bandsawing goes into continuous production, or nears it, it is all the more important to achieve the conditions reached at "C."

Of course, other variables enter the picture—material analysis, material hardness, scale, size, and so on—but they require complete laboratory analysis, which few shops can afford.

Cost nomographs

A better way to determine maximum bandsaw usability and economy



Comparative cutting economies effected by varying cutting rates

	A	B	C
Cutting rate (Sq in./min)	5	10	12
Burden cost (Per 100 sq in.)	$2.00	$1.00	$0.85
Band-life goal (Sq in.)	14,000	1810	1600
Band life (Actual sq in.)	14,000	12,000	10,000
Band cost (Per 100 sq in.)	$0.15	$0.175	$0.21
Total cost (Per 100 sq in.)	$2.15	$1.175	$1.06

is by nomograph. This is done first by figuring out present cutting rate, band life and band cost and burden rate (Nomograph I is set up for determining burden cost per 100 square inches, while Nomograph II is for finding band cost per 100 square inches—including tool changing cost. These two figures together indicate total cost). Next (based on the already outlined limitations of tooth load, wear load, and accuracy) a higher cutting rate should be selected. Then work backward with Nomograph I to find a new, and lower, burden cost. Subtract this from the present total cost to find a new band cost. Next, work backward with Nomograph II to find a projected band life. This is a figure that must be exceeded to make the new cutting rate practical. However, the **actual** new cutting rate will be found only by operating the machine.

Any band life better than that predicted by nomograph represents a profit. This kind of comparison may be repeated—if a conservative cutting rate is chosen first, then a higher rate.

Effect of accuracy

Nomograph III helps establish the maximum cutting rate consistent with accuracy. Two rows of cutting rates are represented, because a 2-inch band cuts with much greater accuracy than a 1-inch band (both references are to HSS bands). Sintered-carbide bands, because they wear better, are more resistant to heat, and yield higher rates.

But while the cutting advantage of the 2-inch band is obvious, it must be balanced against higher tool cost. Two other factors must be considered in choosing band and machine size—sintered-carbide bands have much longer life and cut faster, but HSS bands can now be resharpened.

With 2-inch bands, coolant reservoir capacity, or the lack of it, can be a problem, because the larger blades turn out chips and produce heat at an amazing rate. Not only would a bandsaw operating at high speed need large coolant capacity but possibly mechanical chip removal as well.

From our research at Continental Machines, it is obvious that a 2-inch-band machine can effect appreciable savings in production cutoff work, especially on pieces that are more than 5 or 6 inches in diameter.

A quick calculation of a typical situation, using the nomographs in this article, would readily establish a total cost per cut at two widely differing cutting rates much in favor of the 2-inch machine.

But many existing cutoff machines leave a fairly long stub end. As work size increases, this stub end becomes more and more costly: thus a larger machine must leave as short a stub end as possible.

This same reasoning applies to indexing accuracy—simply because the amount of material which must be allowed for subsequent machining becomes increasingly important as work size increases. •

Metal cutting tool shipments continue to rise

Metal cutting tool shipments by U S manufacturers rose to $330.1 million in 1959, a gain of 4.8% over 1958 shipments and 13.5% over 1954, according to "Metal Cutting Tools: Domestic Shipments for 1959," a report compiled by the Metalworking Equipment Division of Business and Defense Services Administration, U S Department of Commerce.

The 291 cutting tool manufacturing plants responding to the BDSA survey reported individual dollar value of shipments ranging from less than $10,000 to well over $2 million. These plants are concentrated in 22 states, with 61.8% of the production from Ohio, Indiana, Illinois, Michigan, Wisconsin. The New England region is next with 21.9% of the total.

Good business indicator

Because cutting tools are relatively perishable, they are usually required on short notice for prompt delivery, and thus reflect current production activity. In many ways, BDSA points out, current data on production, shipments, and consumption of cutting tools can be a more valuable and accurate indicator of the current industrial situation than other more general indicators.

Three types of tools dominated 1959 shipments: twist drills (21.7% of total shipments), milling cutters (18.5%), and threading tools (16.7%). "Other metal cutting tools" (see table) includes boring bars and tools, engraving cutters, piercing punches, special slotting tools, throwaway cutters, subland tools, core drills, HSS drill and reamer blanks, and special tools made to order. •

Cutting tool shipments 1959

TYPES OF TOOLS	UNITED STATES TOTAL			REGIONS			
	Number of Plants	Value of Shipments ($1,000)	% of Total Shipments	New England	Middle Atlantic	East North Central	Other States
TOTAL	291	$330,127	100%	$72,512	$39,681	$204,193	$13,733
BROACHES	25	12,722	3.7%	2,426	*	9,622	674
TWIST DRILLS	64	71,480	21.7%	9,941	2,512	56,591	2,436
GUNDRILLS	22	1,661	0.5%	698	*	716	47
COUNTERBORES	74	6,251	1.9%	317	137	4,865	932
COUNTERSINKS	56	2,043	0.6%	70	18	1,182	773
REAMERS	113	20,793	6.3%	4,273	1,896	14,009	615
HOBS	11	10,879	3.3%	859	*	10,010	10
GEAR CUTTERS	10	8,920	2.7%	3,743		5,177	
MILLING CUTTERS	148	61,269	18.5%	14,539	7,590	36,937	2,203
THREADING TOOLS	53	55,075	16.7%	31,662	6,356	16,847	210
SINGLE-POINT TOOLS	113	31,661	9.6%	2,325	5,978	21,357	2,001
TIPS, BLANKS, AND INSERTS	36	33,192	10.1%	79	12,136	17,422	3,555
OTHER METAL CUTTING TOOLS	127	14,181	4.3%	1,389	3,057	9,458	277

*Included in "Other States" to avoid disclosure of individual company information.

High component reliability pays off

Why Minuteman hit the jackpot

The Air Force's bold approach to missile development paid off when its solid-fueled Minuteman ICBM made a perfect 4600-mile flight on its first test early this month.

Unlike all previous missile development programs, where each missile stage was first flight tested individually before the whole system was married together for a full-scale test, the Minuteman program was a go-for-broke operation—the first flight test was on the finished missile. (The only basic difference between the test missile and an operational model is its range. Ultimately, the 60-foot-high missile will be capable of traveling over 6000 miles to an enemy target.)

The test was an unqualified success and cut months from the missile's development program. The Air Force now estimates that Minuteman will be operational by mid-1962, a full year ahead of the original schedule. And further tests may advance the program even more.

Reliability the key

Reliability of component equipment is the key to Minuteman's success to date. Hundreds of electronic parts and miles of wiring must withstand the in-flight heat and shock forces that come with firing of a missile. Too, they must be durable enough to function after being held in storage anywhere from three to five years once the missiles are placed in their underground silo launchers or in mobile railroad launchers.

Heart of the electronic control system of this ICBM is its inertial guidance and flight control equipment. As an example of the reliability requirements, components such as transistors, resistors, diodes, and capacitors had to be 100 times more reliable than those available just a little over two years ago, when the Minuteman program got under way.

To achieve this reliability, Autonetics Division of North American Aviation (prime associate contractor for guidance and flight control equipment) started a high reliability program. Autonetics selected thirteen companies to supply parts for its electronic system. The parts were subjected to a severe design and testing program to determine their failure points.

Failures almost non-existent

The end result is a system where faulty components are almost non-existent. Consider the diodes that are supplied by Pacific Semiconductors, Inc. The failure rate presently achieved by PSI is less than 0.0009% per thousand hours of operation. The ultimate reliability objective, however, under Autonetics' continuing reliability improvement study, is 0.0002% per thousand hours. (This study is not a part of the Minuteman production program.)

Once these components were perfected to a high degree of reliability they were standardized. The result is that Minuteman has fewer different parts in it than any previous missile in its size class.

Other advances

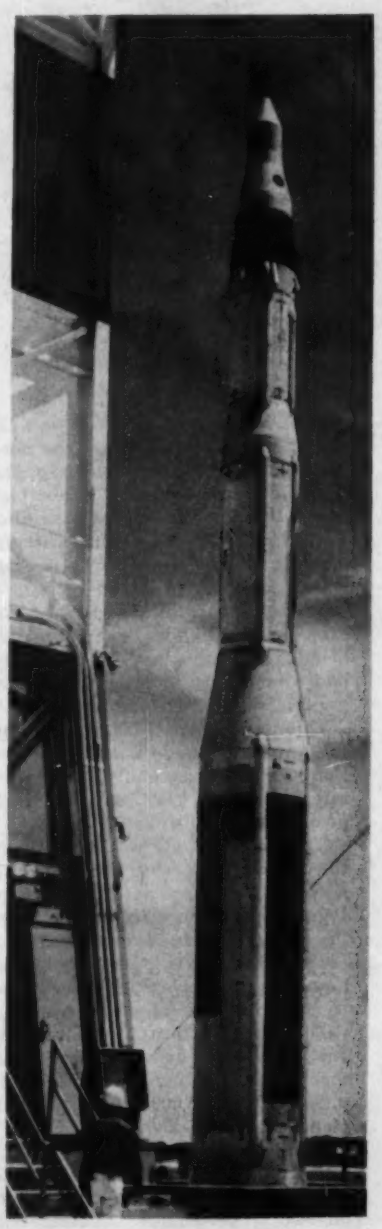
Comparable to the electronics reliability program was one to insure high performance of the three-stage, solid-fueled engines. One problem inherent in solid-fueled engines is getting a uniform propellant burning rate. If propellant grain is not uniform it affects engine performance.

A special optical device called a borescope was developed by Aerojet-General to check the rocket's internal propellant grain surfaces. This is now used to check all three rocket engines on Minuteman.

Another notable achievement is the first application of movable rocket nozzles (for steering) on a solid-fueled missile. They had been used successfully on liquid-fueled engines, but solid-fueled engines subject the flexible tubing used in such nozzles to much higher temperatures—nearly 6000 F.

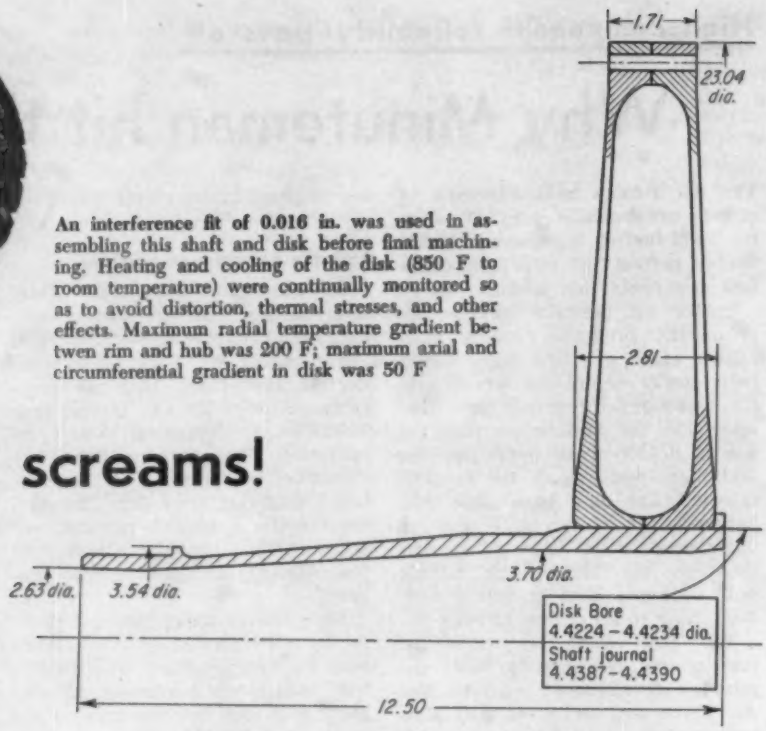
The final movable nozzle system developed by Thiokol Chemical for Minuteman combines new alloys, leakproof seals against high-pressure gases, high density graphites as nozzle liners, and new designing techniques to reduce exhaust temperature.

Thus, when Minuteman was fired down the Atlantic Missile Range early this month, it marked a big advance in missile development. In addition, it scored these first, too: It was the first ICBM ever assembled at the launching site, and its first stage engine is the largest solid-fueled rocket engine ever built—about 24 feet long and 5½ feet in diameter. •



Minuteman model, tests ground support equipment, has dummy nose cone

An interference fit of 0.016 in. was used in assembling this shaft and disk before final machining. Heating and cooling of the disk (850 F to room temperature) were continually monitored so as to avoid distortion, thermal stresses, and other effects. Maximum radial temperature gradient between rim and hub was 200 F; maximum axial and circumferential gradient in disk was 50 F



Shrink till it screams!

By Harry J Kent,

Preliminary Design Studies

Advanced Engines Operation

General Electric Co, Evendale, Ohio

Shrink fitting to four times the normal amount of interference is roughly akin to passing the proverbial camel through the eye of a needle. Yet it can be done, and without creating unsafe stresses in the metal.

The job: shrink fitting a hollow 4340 steel shaft into a disk of the same material. This assembly, part of a lift fan rotor for VTOL aircraft, had to satisfy calculations based on gyro loads of 2 radians per second.

This meant that GE-Evendale had to produce a 4.4-inch-diameter shaft and disk assembly calling for interference of 0.004 inch per inch of diameter, or 0.016 inch in all.

The hollow shaft was tapered on the OD and ID, and the disk consisted of two circular halves bolted together to form a hollow section. Theoretical calculations based on hollow shafts indicated that the desired heavy interference fit could be used within safe stress levels.

For example, tangential stress for zero rpm at the disk bore works out to be 80,000 psi for the shaft (compression) and 25,000 psi for the disk (tensile).

Metallurgical data showed that the disk could be heated uniformly to 850 F to 900 F without affecting its physical properties. Calculation showed that growth of the disk, and shrinkage of the shaft at -60F, would provide adequate clearance for assembly purposes and still allow for the necessary 0.004 inch per inch of diameter interference when the assembly regained room temperature dimensions.

Shaft cooled, disk heated

The hollow shaft was cooled to desired sub-zero temperature by submerging it in dry ice for one hour. Heating the disk, however, required caution so as to prevent thermal gradients, distortion, and hot spots.

Both halves of the disk were heated together, with attached thermocouples continuously recording temperatures during the heating and cooling cycle. The object: to maintain a higher temperature at the rim, with a maximum temperature gradient of 50 F from rim to hub.

Although this condition was easily obtained during the heating cycle, the disk bore temperature dropped rapidly when the cold shaft was assembled with it. Resulting temperature gradient exceeded 50 F.

However, in checking the experimental assemblies for distortion, axial and radial runout, change in the internal diameter of the hollow shaft, and other details, all were found to be within allowable manufacturing tolerances. Magnaflux and ultrasonic inspection showed the components to be structurally sound.

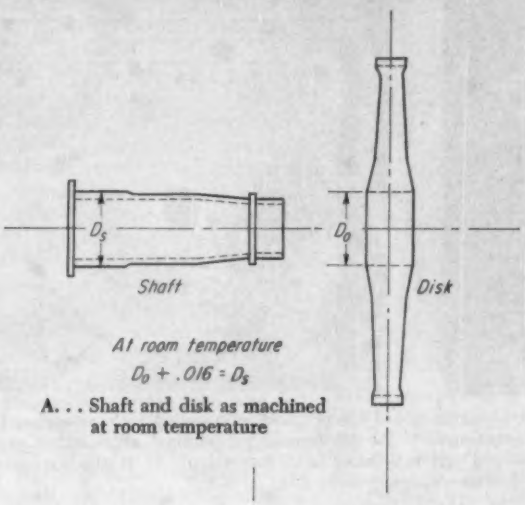
Four assemblies were then made on a production basis. Shaft diameters were machined to 4.4336 in. and disk bore diameters were 4.4176 in., providing an interference fit of 0.016 in. at room temperature. Each disk was positioned horizontally in a special furnace on a press table and heated to 850-900 F in an air atmosphere for one hour.

Clearance for assembly

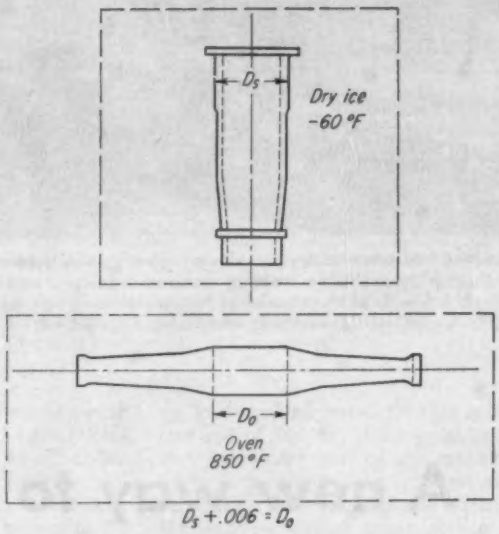
Resulting expansion of the disk bore (about 0.019 in.) brought this diameter to 4.4366 in. Meanwhile the shaft was cooled to –60 F in dry ice for one hour where shrinkage of approximately 0.003-in. reduced it in size to a 4.4306-in. diameter. The top of the furnace was then removed and the disk bore and shaft OD checked for size. The resulting difference in size provided 0.006-in. clearance for easy assembly. The shaft was then run into the disk bore on an arbor for alignment; the arbor was removed when the two components were seated. A press force of 10,000 lb on the shaft insured full contact of the shaft flange with the disk face.

When the assembled components returned to room temperature, interference provided an extremely heavy shrink fit. •

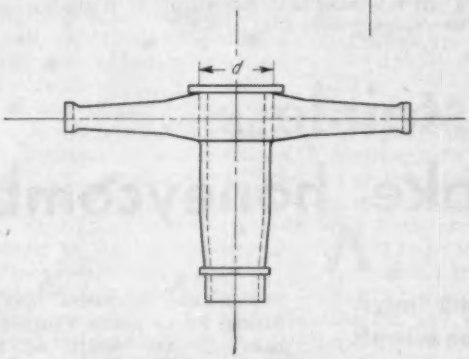
HOW THE JOB WAS DONE



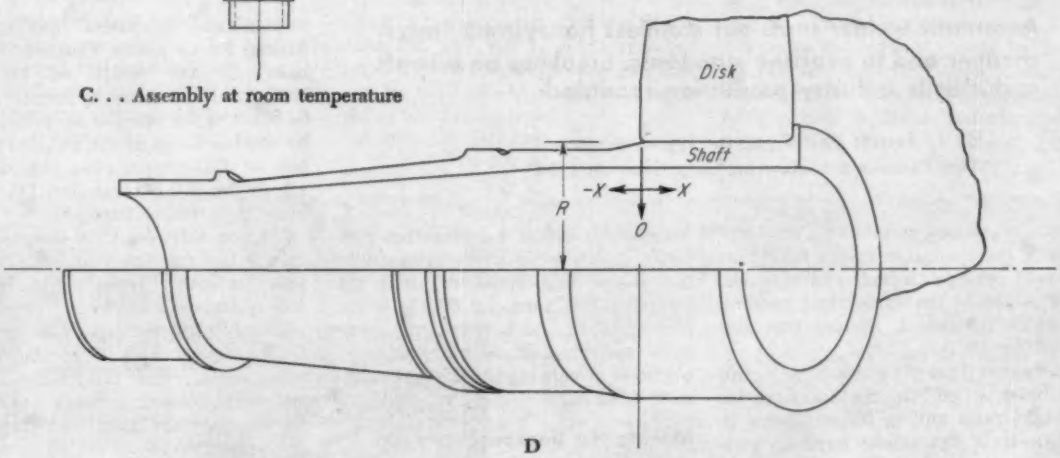
A. . . Shaft and disk as machined at room temperature



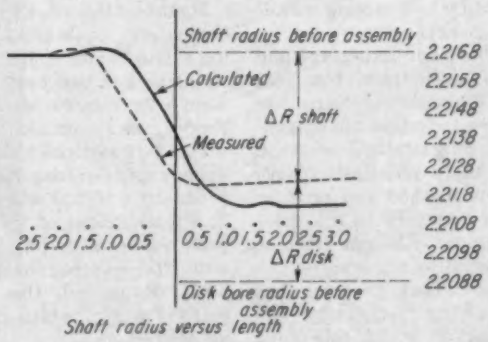
B. . . . Cooling the shaft and heating the disk



C. . . Assembly at room temperature

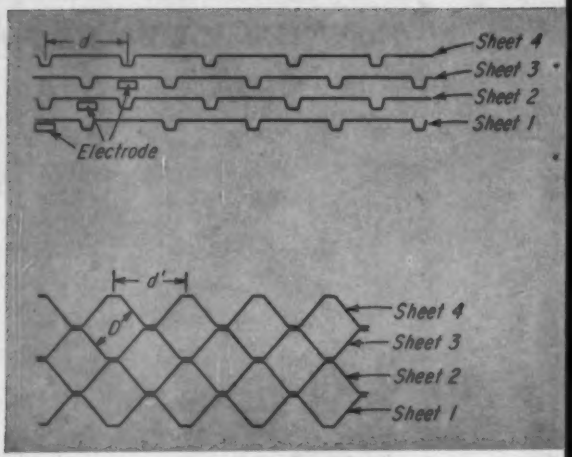


D



Shaft radius versus length

At room temperature dimensions (before assembly) the disk bore was machined 0.016 in. under the nominal shaft diameter (A). Shaft was then cooled in dry ice for one hour to -60 F, and the disk heated to 850 F, also for an hour (B). In this way, 0.006 inches clearance could be allowed between the shaft OD and the disk ID for assembly (C). Return of the assembly to room temperature dimensions gave the required extra-heavy interference fit (D).



Machine tool construction provides a high degree of accuracy in this special resistance welding machine developed at Tool Research Co. to produce stainless honeycomb core. Sketches indicate method of inserting electrodes between strips of stainless foil for progressively joining cells at nodes. Dimension d is the pre-formed longitudinal pitch and is expanded d' after welding and machining. D is the expanded cell size—ranging from ⅜-in. to ⅝-in.

stainless
A new way to make honeycomb

Automatic welder turns out stainless honeycomb faster, cheaper and to exacting standards, breaking an aircraft and missile industry production roadblock

By G Jewett Crites, manager special products
Tool Research & Engineering Corp, Compton, Calif

Stainless honeycomb has become virtually indispensable in the construction of jet age aircraft and missiles, but it has at the same time become a prize bottleneck to quantity aircraft production.

Granted that stainless honeycomb is unequalled in its strength-to-weight ratio and in its resistance to heat—it is extremely hard to produce in quantity to exacting standards. And it is expensive.

That is, it *has* been expensive and hard-to-make up to now, but Tool Research & Engineering Corp has come up with a technique that promises to make this strategic material cheaper and more plentiful. What's more, the new method can produce core blankets that vary in thickness and which can easily be machined to closer-than-usual tolerances.

For example, Tool Research has designed a welding machine for automatic production which can make stainless core up to 6 inches thick at a minimum rate of 8-board-feet-per-hour. Actual production rates are so far above this, however, that the company can turn out 25,000 board feet a month. As a result, the company assures fast delivery of core blankets of varying thicknesses within ± 0.001 in.

Making the unexpanded pack

Manufacture of the unexpanded honeycomb pack begins with feeding a number of strips or ribbons of stainless foil one over the other to form a stack in the welding machine. Feeding is automatic.

Foil material and thickness depend upon customer requirements: strip is usually 6 inches wide, 12 feet long. The total height of the unexpanded pack varies with foil thickness and with the number of ribbons in a pack. Expanded, this is the core blanket width, which can be varied as desired.

(Editor's note: Because the terms "width" and "thickness" may be confusing, let us define blanket "thickness" as the width of the foil strip itself (usually 6 inches), and "width" of the blanket as determined by the thickness of the foil, the number of foil strips, plus the size to which the cell is expanded (¼, 3/16, or ½ inch, etc, as desired).

Copper electrodes are inserted between the stacked ribbons at staggered intervals along their length—the distances between electrodes varying with the cell size desired. For example: ½-inch spacing for ¼-inch cells. The electrodes, while spaced the same distance apart between alternate layers, are staggered from layer to layer. In other words, staggered intervals of ⅜ inch on one layer and on the layer above it form 3/16-inch cells.

One ribbon at a time is welded to the ribbon below it. This assures a good weld on all strips, because it prevents weld penetration of more than one ribbon at a time. Weld nuggets are produced at a rate of about 3000 per second.

The resulting 12-foot-long welded pack usually contains enough ribbons to expand into a 4-foot core blanket. In the case of 3/16-inch cells, this requires 416 ribbons.

Next step, cutting of longitudinal

strips from the welded pack, is done on a bandsaw equipped with a hydraulic table and special clamps. The resulting strip width (thickness of the core blanket) is controlled within ±0.015 inches.

When closer tolerances are necessary, the pack is sliced by a spiral end mill within ±0.001 inches. Before milling, the unexpanded pack is clamped to the machine table with such pressure on the welded cells that the individual ribbons of foil support each other, achieving nearly 99% of theoretical full density in the stack of core. For example, a pack of 426 ribbons or sheets of 0.001-inch-thick foil is compressed until it is only about 0.430 inches thick.

After milling has been done on one side, additional clamps are secured on the opposite side before the original clamps are released for cutter access in milling the opposite side. In this way, both cuts on the blanket faces are made with the pack in a single position.

This method of cutting and machining a slice of core not only makes accurate blankets of any required thickness, but eliminates ribbon mismatch (one row of cells higher or lower than other rows)—a common hazard in making honeycomb core in the expanded condition.

In these operations, the stainless foil is slit precisely to the desired thickness of the finished core, and is then preformed to produce the cells. Next, two such strips are inserted in a welding machine to join the cell nodes. In mass production, however, it is almost impossible to get all the ribbons exactly aligned at the nodes.

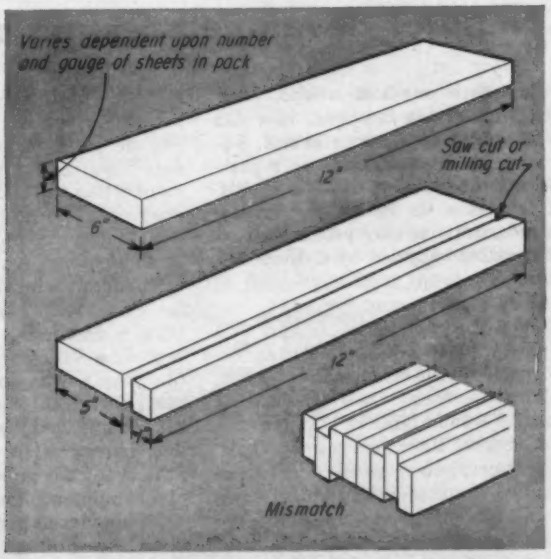
The importance of avoiding mismatch is forcibly brought home later when facing sheets are brazed to the core. If these sheets are not in intimate contact with every cell, voids occur in brazing. Usually, the sheets must "fit up" within 0.003 in.—because this is the maximum gap that can be bridged by surface tension of the brazing material.

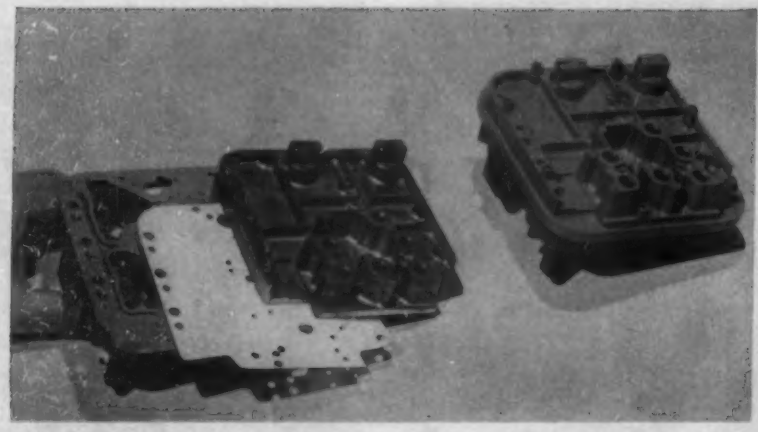
A special expanding machine opens up the machine pack. In this setup one end of the core slice is fastened to a stationary end of the machine with pins which run through the cells. The other end of the pack is similarly secured to a moving member. The moving section pulls the pack open, expanding it, through action of a leadscrew drive.

Pins in the core cells slide in slots, so that they move laterally during expansion to allow for foreshortening of the core without distorting the core blanket. •

Either bandsaw cuts or milling cuts are used in slicing welded honeycomb packs, depending upon core blanket thickness requirements. The planer-mill in the background holds thickness tolerances of plus or minus 0.001-in. while saw cuts are only accurate within plus or minus 0.015-in. Both machines employ rigid clamping during the operation. The unmachined side is clamped for cutting before the clamps on the finished side are released, to prevent movement of the material

Milling a welded honeycomb pack with a spiral end mill produces core blanket thicknesses within close tolerances. The pack is clamped down to about 99% density—making the operation similar to milling a solid bar of steel. This tight prsesure prevents "mismatch" and the formation of burrs, in addition to providing high dimensional accuracy





Die-cut adhesive film is inserted between faces of manifold sections for bonding—a technique that insures uniform adhesive thickness between mating sections

Adhesives cut manifold assembly costs

By adhesive bonding two manifold sections instead of assembling them with conventional fasteners and sealers, Taylor Instrument Co of Rochester, N Y, has cut production costs 50% per assembly.

The assembly: a pneumatically controlled manifold for controlling such process variables as pressure, temperature, and liquid level. Formerly (with the fastener and sealing method) individual manifold sections had to be masked, painted and baked before assembly—because the sealer could not withstand the high baking temperatures of the enamel.

When this was done, sealer had to be sprayed on mating surfaces of the manifold sections and the two sections assembled with stainless steel screws. Sealer thickness was difficult to control and created high and low spots. Too, the recess in the head of each screw required filling so as to prevent accidental removal in service.

Taylor Instrument's new adhesive assembly method consists of solvent-tacking a die-cut adhesive film to one mating manifold surface, then joining the two sections with plain steel screws. These screws apply required pressure for adhesive curing operations.

The film adhesive is Scotch-Weld structural film adhesive AF-6, made by Minnesota Mining & Mfg Co.

This material provides uniform thickness throughout the joint, and a continuous contact between mating surfaces—so that sealing and bonding can be performed in one step.

The entire assembly is then spray-painted with an epoxy enamel and is placed in an oven for an hour at 350 F, to cure the adhesive film *and* the enamel.

Because of the high strength of the bonded assembly (more than 3000 psi), it is possible to remove the screws after the curing operation, but this is not normally done because the labor cost for removing the screws exceeds their value.

Moreover, the heads of the screws do not have to be filled, because they have been painted and thus blend in with the assembly. (Formerly, the stainless screws contrasted unfavorably with the gray paint.)

Not only does the bonding technique reduce assembly costs, it eliminates rejects and failures in the field caused by leaking. Leak testing operations and corresponding labor costs are thus reduced by 90% and the assembled manifold is of higher quality and appearance. •

Computer-developed designs drawn electronically

In less than one-half second, complex engineering drawings now can be produced by electron beams. Appearing as a video image on a cathode-ray-tube screen, especially coated to retain its image for several seconds, drawings are produced from information supplied by a computer. Then the screen is photographed to provide a permanent record.

The S-C (Stromberg-Carlson) 4020 High-Speed Microfilm Recorder, developed by the Information Technology Division (San Diego) of General Dynamics Corp's Electronics Div. draws lines, curves, symbols, and dimensions necessary to make detailed multi-view drawings. Once the engineering specifications are placed in the computer, the S-C 4020 can be asked to produce drawings of any view or cross-section of the potential part in three dimensions.

In addition to producing the part drawing, the same computer code can be used to prepare tapes for data input to the production equipment. Then the latter will physically produce the desired part. Thus, the total concept of numerical control is brought into play.

Of course, when numerical control is used with computer-prepared tape, a drawing is not essential except as a visual record or guide to the people who must visualize the part. However, expensive mistakes can be avoided by checking drawings before work starts or after a prototype is completed.

A computer in tandem with the S-C 4020 can develop most graphic patterns for processes requiring calculations—including work layout, complex wiring diagrams, comparator screens, and mathematical curves.

The S-C 4020 records information on 35-mm microfilm. Printing is accomplished by photographing displays on the face of the Charactron Shaped-Beam Tube, the heart of the printer. The drawing is completed by a combination of characters, selected and displayed on the screen.

Permanent storage of large quantities of data in minimum space is made possible by the compact size of the film. Any frame can be photographically enlarged and reproduced in any quantity. An accessory unit permits automatic processing and projection of the film on a 2 ft by 2 ft screen within 8 seconds.

Originally designed as readout equipment for computers and as a data plotter, the recorder places data on microfilm at 17,500 points per second. Business headings can be superimposed on any frame of film. •

Can we stop auto-body corrosion?

Materials, and the methods to work them, are available to make quantity production of truly corrosion-proof auto bodies a practical reality. Here are some of the problems plus the technology needed to overcome them

For years the auto industry has sought methods to produce a corrosion-proof, all-metal auto body. Individual bodies have been built that are truly corrosion proof but these bodies were not manufactured in the same price range as the market-oriented automobile. In fact, while they might last "forever," the cost of these special bodies was in the prototype category. They did prove it could be done.

Considerable progress has been made in improving the corrosion resistance of conventional bodies. However, to achieve the ultimate objective, a whole array of new technology must be analyzed, selected, improved, and applied.

Herbert D Van Sciver of The Budd Company's Materials Research Laboratory (Philadelphia) feels that we are at the threshold of success. At the 1961 SAE International Congress and Exposition of Automotive Engineering, at Detroit's Cobo Hall, he described the trends in metallurgy and manufacturing.

Forming

Before we replace low-carbon-steel with material having high corrosion resistance, we must consider what forming does to the material as well as what the material does to the forming process. Taking SAE 1010 steel as a standard, as current body designs are based on how 1010 can be formed, compare the properties in the table below.

Galvanized and nickel-coated steels, properly processed, have the same drawing qualities as uncoated metal. Only one change has been noted: Zinc coating acts as a lubricant and must be accounted for in blankholder shape and pressure to avoid wrinkles.

Stainless steels in the 200 and 300 series offer very large available elongation, coupled with favorable yield-tensile ratio, to allow extreme stretching without local failure.

The 400 series stainless steels impose some shop problems, because the higher yield and ultimate strengths do not improve the yield-tensile ratio, and elongation is less than with 1010. The 400 series is limited to the less severe draws, where multiple operations are permitted.

Corrosion-resistant aluminum alloys have about the same limitation as the 400 series stainless steel. Although there is a favorable yield-tensile ratio, the available elongation is less than 1010 steel and, in some grades, there are tendencies toward galling in the die. The low modulus of elasticity calls for particular care to avoid wrinkles and excessive springback.

Any of the plastic-coated steels will stretch the same as uncoated material. Flow through the blankholder, however, imposes some problems, and formations are limited to pure stretch forming, bending, or rolling.

Deep drawing ceramic-coated steel is impractical. While the ceramic coating may not interfere with drawing the metal, the coating will certainly not survive this process.

	Std	Coated	Stainless			
	1010	steel	200	300	400	Al
Yield (X1000)	25-30	25-30	55	40	40	13
Ultimate (X1000)	40-45	40-45	105	90	70	28
Modulus (X10°)	29	29	28	28	29	10
% Elongation	35-50	35-50	55	60	25-30	25-30
Yield/Tensile Ratio	0.55	0.55	0.52	0.44	0.55	0.46

Materials with a protective coating, such as galvanized, nickel-coated, aluminized, or plastic-coated steel and clad aluminum, are corrosion resistant as long as their coatings are unbroken. Sheared edges, punched holes, score marks, and sometimes severely stretched areas, create potential corrosion areas. This is offset in galvanized and aluminized steel by the galvanic protection of the coating.

Welding

Automobile bodies are complex structures constructed entirely of *sheet* steel. Today, it is difficult to think of a sheetmetal automobile body without thinking of spotwelding for assembly.

Automotive subassembly often is done in welding fixtures which allow many welds in a single operation. Welding current and electrode force are usually limited by lack of space. Also, because many of the welding guns are inaccessible, long electrode life is vital.

The remainder of the spotwelding is done with portable welding guns. Here again welding current and electrode force are limited, although for a different reason—portability.

Stainless steels present no problem. Welding current, electrode force, and electrode life are of the same order of magnitude as for 1010 steel. Nickel-clad steel should fall into the same category.

Zinc- and aluminum-coated steels also fall within the electrode-force and welding-current limitations of automotive-assembly practice. These materials have the special problem, however, of having the coating metal adhere to the electrode. Also, aluminized steel requires a preweld cleaning to remove the surface oxide, just as with aluminum sheet.

Primers a problem

Precoating with organic primers or zinc-base primers presents an electrode contamination problem. Also, the primer must be either conductive or sufficiently mastic to be displaced by the electrode and thus make good electrical contact with the steel. Many primers have a limited welding life before they "set up" so that welding is impossible.

Areas that retain moisture, such as crevices, are of major concern in

Material (0.040 in.)	Current	Electrode Force	Surface Condition	Electrode Life
SAE 1010	8000	500	Free of dirt & rust	
			and light oil	5000
18-8 SS	5000	900	Free of dirt	5000
400 Series SS	6000	800	Free of dirt	5000
Aluminum	30000	600	Chemical or mechanical	
			oxide removal	300
Galvanized 1010	12000	700	Free of dirt	1000
Nickel Clad 1010	10000	600	Free of dirt	5000
Aluminum 1010	11000	700	Chemical or mechanical	
			oxide removal	300

corrosion protection. These areas also are the most difficult to seal off in subsequent painting. Resistance spotwelding demands that parts to be joined be over lapped—producing crevices. It is not practical to make flush-butt spot-welded joints. However, crevice-free joints can be made using arc welding.

Arc welding becomes more difficult and more critical as the gage gets thinner. At 0.035 in., a conventional body thickness, the process has been limited to slow manual operations. Recently semi-automatic processes have been developed that do lend themselves to lighter gages.

Arc welding has limitations not necessarily the same as spotwelding. The joint must be accessible, and parts must fit or be capable of being brought together by fixture clamping. Thin gages must be backed up with water-cooled-copper chill bars to prevent burn-through.

The 200 and 300 series stainless steels present no arc welding problem. Speeds of 100 ipm are promised.

Nickel-clad steel should weld about like stainless steel. A stainless electrode must be used to preserve the corrosion-resistant surface.

Galvanized takes care

Galvanized steel welds like carbon steel, with two exceptions: Zinc melts ahead of the arc and occasionally an accumulation of zinc and zinc oxide causes a momentary change in arc characteristics. The result is a slight porosity. Porosity can be avoided by improved techniques or electrode material. Weatherometer tests have shown arc-welded, galvanized-steel joints to be corrosion resistant without further protection, provided the zinc removal area does not exceed $\frac{3}{4}$-in.

All aluminum alloys are arc weldable, but both strength and corrosion resistance suffer in the heat-treatable grades. If the structure cannot be heat treated after welding, the weld deposit and the heat-affected zone will be left in a softer condition.

Where welding without post-treating is feasible, through the use of a high tensile filler wire, or through joint design, it may be accomplished at rates up to 60 ipm using the inert-gas-shielded metallic arc.

Adhesive bonding

Many designers have an aversion to glued or cemented structures which stem from failures of improperly applied adhesives, or using adhesives in wrong applications. The right adhesive used in an assembly designed for adhesive bonding can result in a satisfactory structure.

It is necessary to provide a lap, the area of which is sufficient to develop the joint strength. This lap need not provide a crevice as in spotwelding, because the adhesive will fill the crevice.

Good design practice for bonding dictates that the joint be loaded in shear—never in tension or peeling will result. Actually, this is true of spotwelding, but we know that this rule is often violated in automobile-body design. For adhesive bonding to be successful, the rules must be followed.

Why hasn't bonding been used more extensively? There are several reasons: First, adhesives must be applied to clean dry surfaces—a condition seldom met in automobile assembly. Second, the parts must fit over the entire surface to be bonded. There is no spot-welding gun to act as a clamp to force the pieces together. Third, the adhesives require either time or heat to cure and develop strength. While heat is available in the paint ovens, the green strength of most adhesives is insufficient to keep the parts in registry until cured. Furthermore, subassemblies often require considerable handling before final assembly and the paint-oven treatment.

These problems can be remedied if we approach the body design with adhesive bonding in mind instead of spotwelding. There is only one remedy for dirt: cleanliness. Adhesives being developed will be compatible with oil films, thus allowing subassembly bonding without repetitive cleaning and re-oiling.

Fit-up is tough. Aside from providing better fitting parts, many joints can be made self fitting by press clinching, as is presently done in doors, deck lids, and hoods.

To overcome low green-strength and long set-up time, one tooling company has designed assembly fixtures incorporating induction-heating coils which will cure the adhesive in a few seconds—a time comparable to spotwelding assembly time. Heating is mild, involving temperatures of only 350 F. It is not necessary to cure the entire joint, but only enough area to give the assembly the necessary strength to survive subsequent handling. Eventually many resins will self cure (about one day) or paint oven temperature will cure the remainder of the joint.

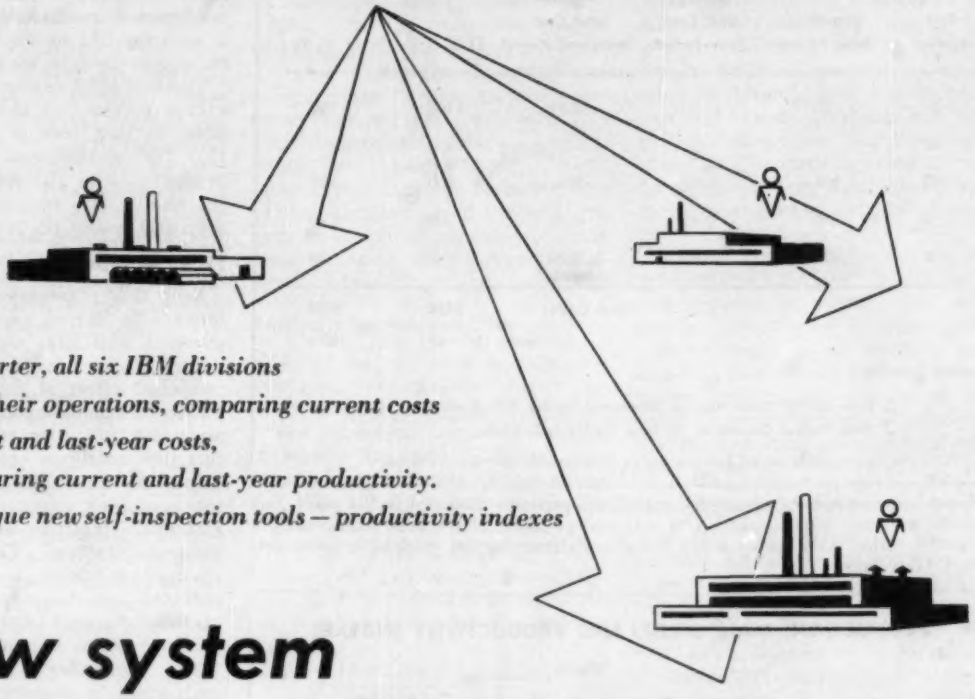
There has been a natural reluctance to combine aluminum and steel in automotive structures because of the danger of corrosion due to electrolytic action. Besides, aluminum and steel are not compatible for welding. Bonding overcomes both of these objections.

Team effort needed

While we have every right to expect improvements in both materials and manufacturing methods, all the elements to produce the corrosion proof, all-metal automobile body exist today. The breakthrough to the actual production of the corrosion-proof body will start with the stylist and continue with the structural designers and the manufacturing process groups. It must be a team effort —with the full cooperation of the manufacturing units to ensure that quality standards are met.

This breakthrough will impose on our shops materials and fabrication methods with which they are not familiar—so the transition must be gradual. It will also require time to develop the design data to take full advantage of the materials and joining methods. However, we have every reason to expect that corrosion proof all-metal automobile bodies will be produced in this decade. •

PRODUCTIVITY INDEXES:



Every quarter, all six IBM divisions evaluate their operations, comparing current costs with target and last-year costs, and comparing current and last-year productivity. Their unique new self-inspection tools — productivity indexes

New system evaluates cost targets

By Tom Johnson, associate editor

Just how well are we doing, relative to the outside world? What has been happening to product costs? How does this year's productivity compare to last year's?

These are questions that tantalize top management in every company —even more so today than in the past. Now the International Business Machines Corp gets answers to these frustrating questions frequently—and routinely.

Quarterly indexes

IBM's important new system: productivity indexes, compiled every quarter by each of its fifteen manufacturing plants and six divisions. Here are the principal benefits to IBM (and to management in firms interested in productivity!):

- The indexes are important diagnostic tools for analyzing cost trends.
- With them, the company can compare results with those of domestic and foreign industry.
- In planning for the future, the indexes can help answer such difficult questions as these: How much will productivity have to rise to offset expected increases in wages and burden? How much of a productivity rise is due to improvements in methods? in labor performance?

Approach to productivity

Productivity means many things to many companies. But IBM's approach eliminates much of the ambiguity found in more complicated concepts of the term. Its definition of productivity: *physical output per unit of labor input.* Inputs of capital and materials are excluded, because IBM feels that these can be measured more directly in other ways.

The IBM system is designed to reflect manufacturing trends only. Sales prices don't creep into the picture here. At IBM, sales figures would be deceptive, anyway. A large percentage of its products are not sold, but rented; therefore sales do not reflect true production in a given period.

What the indexes are

Productivity indexes measure changes in physical output per worker between a base period and the measured (current) period. The result is a percentage figure, or index, that shows the change in productivity since the base period. Measuring only *physical output* removes such troublesome factors as changes in labor rates and accounting practices during a period.

More specifically, computing the index involves three steps:

(1) Determine the change in total output between the measured (current) period and a base year. This change, called a *production index,* reflects changes in physical quantities of output. (Unit costs for both periods are equalized by a procedure explained later.)

(2) Determine the number of workers in both periods. This is called the *manpower index.*

(3) Get the change in output per person (or *productivity index*) by dividing the production index by the manpower index.

One of the most interesting as-

IN-PLANT SUB-PRODUCT COST INDEX

Part Number	(1) Quantities, Base Period	(2) Average Unit Cost, Base Period	(3) Average Unit Cost, Measured Period	(4) (1 × 2)	(5) (1 × 3)
A	100	$1.00	$0.93	$100	$93
B	*	—	—	—	—
C	200	0.50	0.60	100	120
D	100	0.40	0.40	40	40
E	50	0.80	0.70	40	35
			Total Costs:	$280	$228
			Index (5 ÷ 4):		103%

Basic Formula:

$$\frac{\Sigma \text{ Base Period Quantities} \times \text{Measured Period Unit Costs}}{\Sigma \text{ Base Period Quantities} \times \text{Base Period Unit Costs}}$$

*Made during measured period but not during base period, therefore excluded

Sub-product cost index is developed for all sub-products produced in the plant, but includes only the in-plant portion of sub-product costs. This relates base-period to measured-period costs, and is a key factor in determining the production index (see line 4, table below)

PRODUCTION, MANPOWER, AND PRODUCTIVITY INDEXES

(Plant)_____

Base Period 1959 = 100

Measured Period 1960

Production Index — Measured Production	Base Period	Measured Period
1. Annualized Direct Labor	$3,000,000	$3,500,000
2. Annualized Applied Manufacturing Expense	$2,000,000	$2,500,000
3. Total Annualized Direct Labor & Applied Manufacturing Expense	$5,000,000	$6,000,000
4. In-Plant Sub-Product Cost Index	103%	
5. Base Period Produciton at Measured Period Cost (Base Period Total, Line 3 × Line 4)	$5,150,000	
6. Index of Physical Production (Measured Period Costs, Line 3 ÷ Line 5)		116.5%

Manpower Indexes — Measured Production	Base Period (A)	Measured Period (B)	Index (B ÷ A)
7. Number of Direct Workers	700	800	114.3%
8. Number of Indirect Workers	300	300	100.0%
9. Total Direct and Indirect Workers	1000	1100	110.0%

Productivity Indexes — Measured Production	
10. Direct Workers Index (Line 6 ÷ Line 7)	101.9%
11. Indirect Workers Index (Line 6 ÷ Line 8)	116.5%
12. Total Direct and Indirect Index (Line 6 ÷ Line 9)	105.9%

Productivity indexes are obtained by dividing the production index by the manpower indexes. IBM obtains indexes for direct, indirect, and total workers in each plant

pects of the system is the selection of the *base period*. Here it is the calendar year that immediately precedes the current year. The *measured period*, to which it is compared, is each quarter of the current year, on a year-to-date basis.

There is good reason for selecting a base period that is updated each year, so that 1960 is compared to 1959, 1961 to 1960, and so forth. The product line at IBM plants changes so rapidly that comparing 1960 to, say, 1950 would be unrealistic.

Types of indexes

Each IBM plant develops separate indexes for direct workers, indirect workers, and total workers.

Direct-labor indexes show the combined effect of changes in production methods, operator performance, and utilization of available direct time on direct operations.

Indexes for indirect labor show the combined effect of changes in methods, employee efficiency, and indirect staffing. The effect of changes in production volume is reflected too, because the number of fixed indirect workers remains constant while volume changes.

The controller's department in each plant is responsible for computing all indexes and submitting them quarterly to division headquarters, which then assembles its productivity figures. From the combined division figures comes the corporate picture.

Other indexes

Besides its productivity indexes each plant also derives two other sets of indexes:

(1) *Product cost indexes*, which measure changes in the combined cost of all products between the base and measured periods. With these, the company can also compare target trends with actual results, and develop data for establishing, appraising, and revising cost targets.

(2) *Sub-product cost indexes*, which measure changes in every element that goes into the cost of a product: in-plant labor and manufacturing expenses . . . purchased components and assemblies . . . raw materials . . . parts and assemblies received from other IBM plants . . . engineering support.

No attempt will be made here to elaborate on the above two sets of indexes, other than to point out that they are just as valuable, in their own way, as the productivity indexes. What is of concern here is the *in-plant portion* of the sub-product cost indexes, for it is this

element of sub-product cost that is used in calculations of productivity indexes.

Computing production indexes

As mentioned earlier, production indexes show the change in physical output between the base and measured periods. These production indexes, divided by manpower indexes, give the productivity indexes. (Note: The chart reproduced on this page shows the development of these three types of indexes, and will help clarify the text that follows.)

The following ratio represents the change in physical output between base and measured periods:

$$\frac{\text{MP quantities (x) MP costs}}{\text{BP quantities (x) MP costs}}$$

Notice that, to restrict the production indexes to changes in physical output only, it is necessary to hold unit costs constant, so that he index will not be affected by changes in labor rates, overhead costs, or accounting procedures that occur between the base and measured periods. This is accomplished by revaluing base-period quantities in terms of measured-period costs (described below).

The numerator of the ratio is obtained in the following manner:

(1) Secure actual direct-labor and manufacturing-expense dollars for the measured period. This expense excludes purchasing and engineering costs.

(2) Annualize these costs by multiplying the rate per work day times the total number of work days in the measured year.

The denominator of the ratio is derived this way:

(1) Secure actual in-plant expenses for the base period in the same manner as described for the measured period.

(2) Re-value the base-period quantities in terms of measured-period costs. This is accomplished by multiplying base-period costs by the in-plant sub-product cost index. The small chart to the right shows how this re-valuation is done.

One feature of the in-plant sub-product index deserves emphasis: Because base-period quantities are converted into measured-year costs, only sub-products produced *in both periods* can be included in the index. Obviously, in a plant that turns out as many as 30,000 different sub-products a year, not every sub-product will be made in both periods (especially when the product line changes as fast as IBM's). Company experts claim, however, that the number of sub-products excluded is not sufficiently large to affect the index's accuracy, when the base period is moved forward each year as explained earlier.

This matter of exclusion could be of major importance when the product line is rapidly changing; new products are hard to measure, because learning costs are relatively high. Consequently, IBM now excludes new products from its calculations. The company feels that this exclusion, although it reduces the proportion of sub-products covered, actually makes the productivity index more meaningful.

Productivity indexes

Once the production index is available, computation of productivity indexes is relatively simple.

The following ratio (developed separately for direct, indirect and total manufacturing personnel) gives the change in manpower:

$$\frac{\text{Measured-Period Workers}}{\text{Base-Period Workers}}$$

Now productivity indexes can be developed, for each of the three labor classifications, with the following ratio:

$$\frac{\text{Production Index}}{\text{Manpower Index}}$$

These productivity indexes are the creation of the Corporate Industrial Engineering Staff at IBM. Installed in 1958, they are now routine procedure in all the corporation's plants.

"What we wanted," explains S H Wareham (corporate director of Industrial Engineering), "was a system for analyzing and anticipating trends. We were particularly interested in developing a way to compare trends between plants and with industry in general. For these reasons, our productivity index was designed for easy comparison with regularly published national productivity figures."

Perhaps most important of all, the productivity indexes (along with the indexes on product and sub-product costs) offer management a superb chance to set realistic targets and to diagnose differences between these targets and actual results. It is in the area of planning that the new tools have really shown their value.

More indexes coming

In 1961, the system will be expanded to include another set of indexes. Besides the indexes for direct, indirect, and total labor, a fourth set—based on output per direct hour worked—will be made available to management. In a complex company that makes everything from the smallest of components to the largest of computers, such realistic gages of manufacturing efficiency are bound to pay off. •

Two-pass weld.....not twelve

Two-pass welding technique for heavy aluminum plate cuts welding arc time and shielding gas consumption by about 50%, reports Kaiser Aluminum, Oakland, Calif. Square butt joints can be used for plate up to 1¼ in. but beveled edges are recommended for heavier sections. Higher current density (up to 450 amps, 40 volts) produces finer spray transfer of molten aluminum from filler wire (1/16 inch) to weld pool. Pool is large and molten for a long period, allowing gases and oxides to escape. Modified automatic inert-gas, metal-arc equipment is used. For similar work by Linde, see *AM*—May 4 '59, p97. •

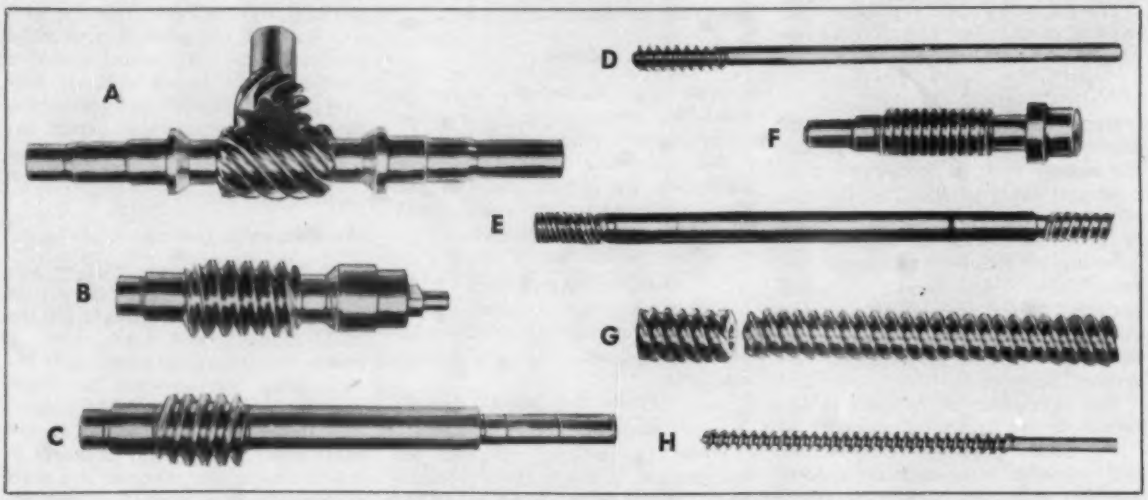
How to design rolled worm threads

You can roll the threads on a worm shaft at lowest piece-part cost and get all the accuracy and wear life that you will ever need. But there are some techniques in worm-thread design, thread-roll design and material selection that you must master first. Here are the rules as developed from research and field study

By E C Hanna, director of engineering, Landis Machine Co, Waynesboro, Pa

Nearly all worm-thread rolling is done in cylindrical-die, thread-rolling machines of the two-die and three-die types. Manufacturing economy of the method can be illustrated by one job:

The differential power-input worm for a well-known riding power lawnmower was originally produced by cutting, carburizing, hardening,



Worm Shafts Produced by Infeed Rolling (All parts used as rolled)

Part A — Machine-tool worm shaft. 8620 steel. Rolled at 220 Brinell

O.D.	1.625
Linear pitch	0.50909
Whole depth	0.252
Helix angle	45°
Pressure angle	22½° (normal)
No. of starts	Eight (teeth)
Thread length	2⅛ in.
Production rate	3 per min.

Part B — Gear-reducer worm. 4140 steel, heat treated. Rolled at 290 Brinell

O. D.	1.503
Linear pitch	0.320
Whole depth	0.221
Helix angle	8°—54′
Pressure angle	25° (normal)
No. of starts	Two
Thread length	2¼ in.
Production rate	5 per min.

Part C — Differential power-input worm for riding power lawn mower. 8620 steel. Rolled at 216 Brinell

O. D.	1.430
Linear pitch	0.3183
Whole depth	0.2157
Helix angle	9°—20′
Pressure angle	20° (normal)
No. of starts	Two
Thread length	1¾ in.
Production rate	8 per min.

Part D — Food-mixer armature shaft. C1040 steel. Rolled at 180 Brinell

O. D.	0.2805
Linear pitch	0.1025
Whole depth	0.065
Helix angle	16°—36′
Pressure angle	25° (normal)
No. of starts	Two
Thread length	⅝ in.
Production rate	15 per min.

Part E—Floor-polisher armature shaft. C1144 steel. Rolled at 210 Brinell

O. D.	0.418
Linear pitch	0.1180
Whole depth	0.0806
Helix angle	18°
Pressure angle	20° (normal)
No. of starts	Three
Thread length	1 in.
Production rate	12 per min.

Part F — Tool-adjusting worm. 4615 steel. Rolled at 162 Brinell

O. D.	0.561
Linear pitch	0.100
Whole depth	0.068
Helix angle	3°—39′
Pressure angle	14½ (normal)
No. of starts	single
Thread length	1¼ in.
Production rate	12 per min.

Worms Produced by Through-Feed Rolling

Part G — Power sander worm. 1118 steel. Bars rolled at 155 Brinell, then drilled and cut-off in screw machine

O. D.	0.747
Linear pitch	0.1963
Whole depth	0.135
Helix angle	21°—48′
Pressure angle	20° (normal)
No. of starts	Quadruple
Thread length	20 ft.
Production rate	55 ipm

Part H — Power window-lift worm. C1018 steel. Bars rolled at 130 Brinell, then cut off in screw machine

O. D.	0.326
Linear pitch	0.1667
Whole depth	0.063
Helix angle	9°—18′
Pressure angle	20° (normal)
No. of starts	Single
Thread length	12 ft
Production rate	50 ipm

and finish-grinding. Its cost was $2.53.

Tooling and production engineers explored production of the worm by the rolling process. AISI 8620 steel was chosen because of its good cold-working characteristics along with excellent work-hardenability.

Rolling trials proved successful. Cost per shaft was reduced from $2.53 to $0.50.

This spectacular cost saving (80%) was made possible by several factors.

First, 1.2 lb of steel were saved per shaft, because this particular worm shaft could be produced from stock approximately equal to the pitch diameter of the worm thread, instead of from stock somewhat larger than the worm OD.

Second, the worm thread could be rolled at the rate of eight pieces per minute.

Third, surface work-hardening produced an as-rolled worm that would out-wear its mating worm-wheel without carburizing or hardening. Fourth, the rolled worm thread was sufficiently accurate to make finish grinding unnecessary.

The advantages of rolling would be exploited to a greater extent if product engineers and production executives were more familiar with the rolling process and its productivity, economy and limitations. There are eight major considerations to be taken into account:

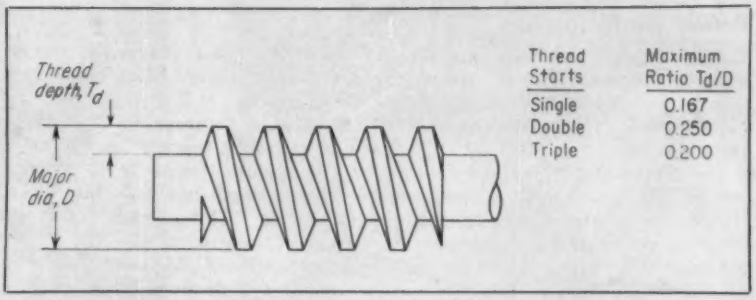
Thread-depth ratio

Thread rollability is limited only by power and size of the equipment and by the hardness or ductility of the workpiece material. However, the ratio of the thread depth to the worm diameter affects straightness and concentricity of the rolled worm and the control over the rolling operation.

The practical maximums of this ratio have been established for various circumstances. See Fig. 1.

Double or two-start worm threads are more successfully rolled to a higher depth-to-diameter ratio than are single- or triple-start threads. This is true because the deformative forces imposed by the dies of a two-die machine are diametrically and equally opposed, and in balance, at all times.

On a single-start thread, the rolling forces at the thread terminals are unbalanced from one die to the other, tending to bend the rolled thread at the thread terminals, as shown in Fig. 2. The same is true, to a lesser degree, on a three-start thread. When



Thread Starts	Maximum Ratio T_d/D
Single	0.167
Double	0.250
Triple	0.200

Fig. 1—Maximum thread depth-to-diameter ratios vary with the number of starts on the worm

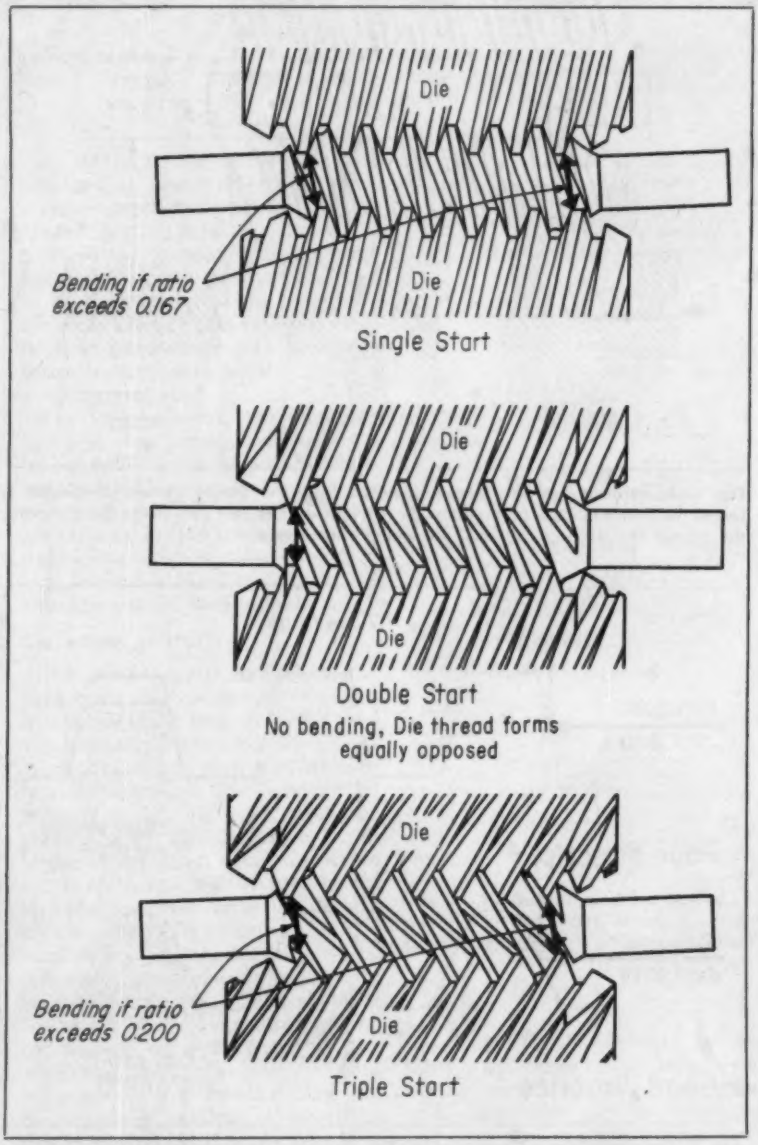


Fig. 2—Straightness of the worm is affected by the number of starts and the depth of the thread. Bending may occur at both ends of the part, for single- and triple-start worms, because forces are unbalanced

Rolled worm threads . . .

the unbalanced thread-rolling force exceeds the elastic limit, the shaft is bent or offset. Eccentricity then exists between the thread and its adjacent journals.

The deeper the thread, the greater the rolling force that is required. Hence, the greater is the unbalance between the rolling forces from one die to the other on single- and triple-start threads.

By trial, these maximum thread depth-to-diameter ratios have been determined:

Single-start threads	0.167
Double-start threads	0.250
Triple-start threads	0.200

Thread depth has important effect on die life. Threads are rolled on stock of approximately the mean thread diameter. Material displaced from the dedendum area of the thread groove flows radially outward to form the tooth addendum, as shown in Fig. 3.

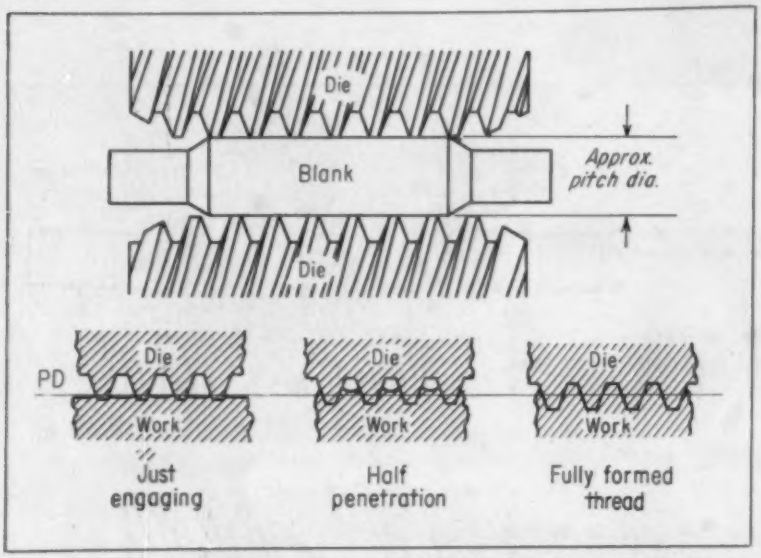


Fig. 3—In forming a worm thread, material from the thread groove dedendum is forced to flow outward to produce the thread addendum. The deeper the thread, the greater the slippage between die and thread elements

When the die penetrates to the minor diameter and the workpiece is fully rolled, the largest diameter of the die runs upon the smallest diameter of the thread, while the largest diameter of the workpiece runs upon the smallest diameter of the die. These various diameters cannot all run at the same surface speed. There must be high-pressure slippage between some thread elements of the die and workpiece.

Thus, it is plain that the higher the depth-to-diameter ratio, the greater the slippage that must occur.

The unit pressure of rolling is high and can approach 450,000 psi, theoretically. The slippage that occurs is very "tight" slippage indeed, with resultant lower die life.

The thread-depth quotient has an effect upon axial movement or end-feeding of the workpiece during penetration. This effect is related to the helix angle, which will be discussed later. It can be seen that the lower the thread-depth ratio the easier the thread can be rolled.

A deep thread is usually specified by designers in order to obtain a coarse-pitch, hence a high lead and a low gear ratio. In this they are bound by conventional concepts of cutting or hobbing worms. However, the thread depth can be reduced to improve rolling and the same leads maintained by these expedients:

(a) Employ the Fellows or Amer. Std. stub-tooth thread form. This modification frequently has desirable effects upon functioning of the gear system.

(b) Increase the worm pitch diameter to reduce the depth-over-diameter quotient while maintaining the same axial pitch and lead. Some increase in the operating center distance is required, but that is a matter of design. This modification will also reduce the helix angle.

(c) Reduce the axial pitch, hence the thread depth, and increase the number of starts to result in the same lead, hence the same gear ratio.

The shallower the thread, the stronger and more durable the die thread will be.

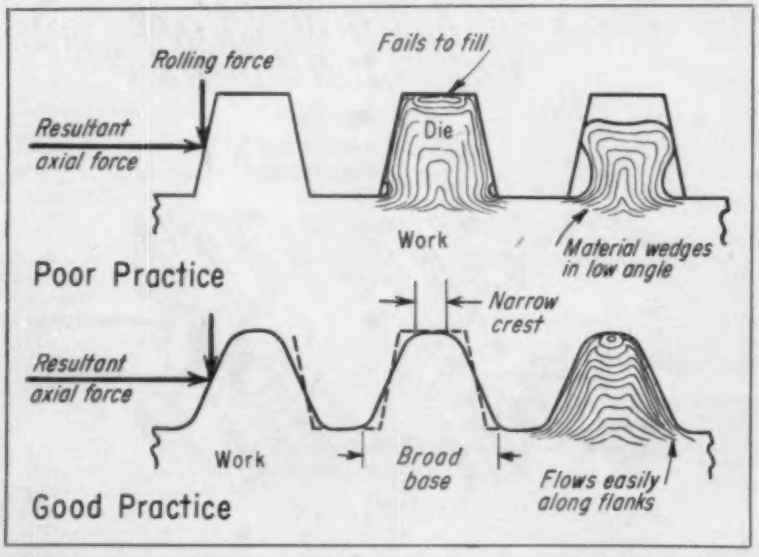
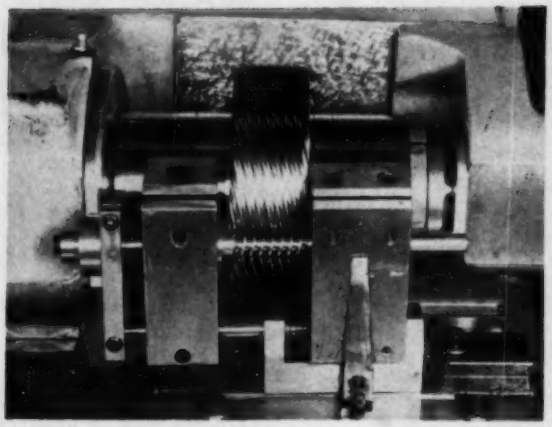


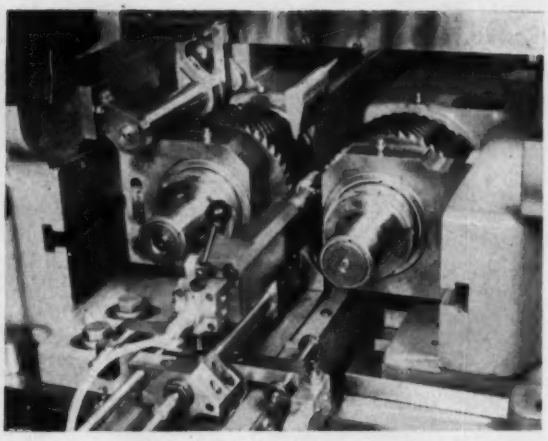
Fig. 4—Employ a high pressure angle. The narrower die crest results in easier penetration and less "wedging" of the flowing material in the die-thread groove. It provides a broader, stronger die thread base

Pressure angle

The second important design factor is the pressure angle. It is practical to roll threads of 14½° pressure angle, but there are several good reasons for choosing a higher pressure angle. Greater ease of rolling,



"Cut away" view of worm thread between shoulders, in rolling position—corresponds to type D in Fig 5



Part A, page 108, a machine-tool wormshaft, is held between centers in rolling position. Production is 3 pc/min

lower rolling pressure, better flow pattern and characteristics, better finish, better control of end-feeding, better straightness and concentricity and better die life can be obtained when rolling threads of higher pressure angles, such as 20°, 22½° and 25°. Threads of higher pressure angles have narrower root and crest flats, so does the die for rolling them. Hence, penetration by the die is easier and lower pressure is therefore required.

Material tends to flow much easier around the narrower crest flats and up the flanks of dies of higher pressure angle. See Fig. 4. With lower pressure angles, hence wider die-crest flats, the work material tends to spurt axially as well as to flow radially from penetration of the die thread. The moving metal must make a turn in order to conform to the thread form. This is called "turbulence" and it requires extra pressure. The lower the turbulence the better the flow pattern.

With a higher pressure angle, the die-thread base is wide, hence stronger and better able to resist transverse breakage. It is easier to produce simultaneously the required over-wire dimension and the major-diameter dimension within tolerance. Rolled worm threads of higher pressure angle operate with reduced interference, noise level and increased efficiency.

Root and crest corner radii

The largest possible corner radii should be allowed at root and crest. A large crest-corner radius on the die thread eases penetration and facilitates the flow of displaced material. Radial flow of material is then obtained at lower rolling pressure. A large crest-corner radius on the die facilitates material flow around it, to form the worm-thread crest and again reduces the pressure required to flow material into the narrowing die root. Further, it is extremely difficult to grind sharp root corners in thread-rolling dies without causing cracking.

For these reasons, the minimum root and crest corner radii are 0.005 in. but 0.010 in. is preferred. A larger radius facilitates crush-forming the die-grinding wheel and grinding the die threads, avoids stress concentrations and damage to the die in grinding, and contributes greatly to the strength and durability of the die.

Die edges or starts

Die threads must exit or disengage from the workpiece threads at one terminal, or both, in some suitable manner. The most common treatment of die edges or thread starts is to chamfer them. The conventional chamfer is 30° measured from the die axis, or 60° included angle. Depth of the chamfer can equal the whole depth of thread, but it is practical to make the chamfer depth slightly greater than the depth from the blank surface to thread root.

In any event, there will be a length of shallow thread at least equal to the length of the die chamfer. Some end-feeding or axial travel of the workpiece inevitably occurs during the penetration phase of rolling. So, the length of shallow or imperfect thread will be equal to the length of chamfer at one end of the thread and equal to the length of chamfer *plus* the length of end-feeding at the other. By correct die design and rolling technique, end feeding or axial movement can be minimized and controlled to occur in one direction only.

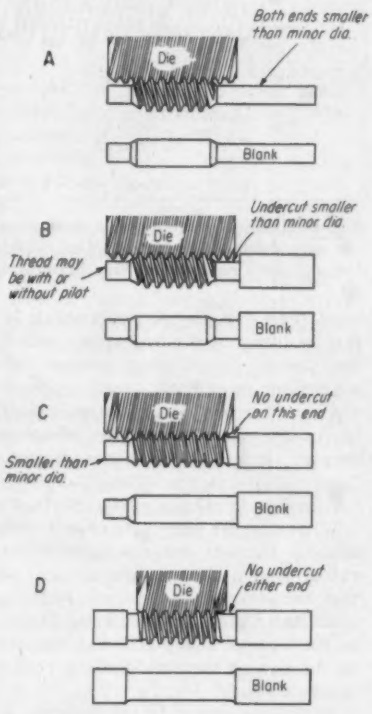


Fig. 5—Allowances must be applied, according to the design of blank. Worm threads are rolled on four types of blanks

Die chamfers less than 30° meas-

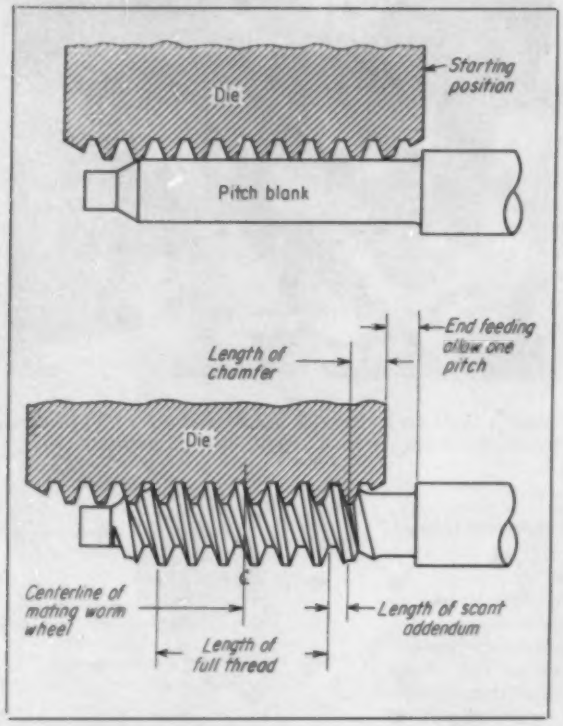


Fig. 6—Relative position of the workpiece and die will change because of end feeding or axial travel during penetration. Allowance must be made for this when designing the blank

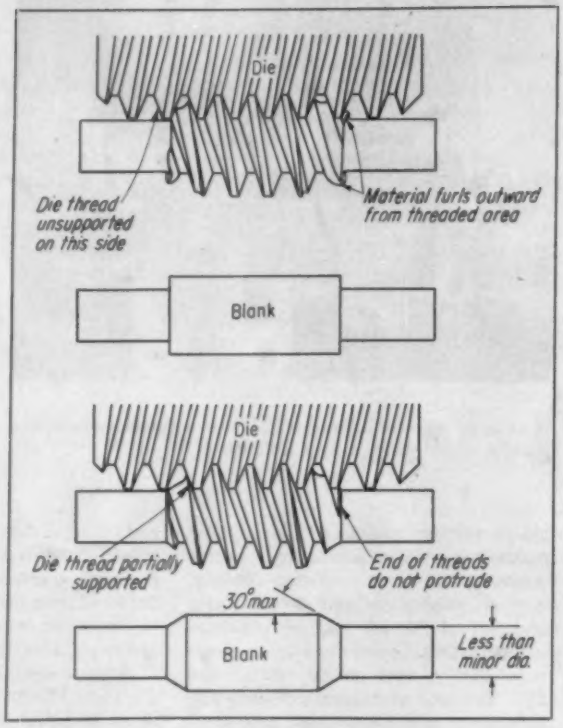


Fig. 7—If the worm blank is not chamfered, the chances are that the unsupported die thread may be broken by transverse force exerted by the work material

ured from the die axis will result in less bending of the workpiece when the thread depth must exceed the maximum quotients given. Lower die-chamfer angles, or course, result in longer chamfer lengths, hence a greater length of shallow thread. Lower chamfer angles will also result in less breakage of die starts.

When the die edges are chamfered, the die threads are conically truncated. Sharp shear edges are left at the corners of the broad angular crest flats of the thread starts. These, in turn, leave sharp root flat corners in the thread terminals of the rolled worm threads.

If this condition is undesirable, it can be avoided by applying convolute form relief to the thread starts. Each die-thread start is individually coneccentrically ground to a thread profile which maintains the crest-flat width and corner radius but to a higher pressure angle. The form relief begins, usually, at a distance equal to the axial pitch from the edge or flank of the die. It is an arc tangent to the periphery of the die major diameter and of radius such that at the flank or edge of the die the start relief will clear the blank.

The convolute form-relieved start affords a smooth, clean exit of the die thread from the rolled workpiece thread. However, die cost is significantly increased. Form-relieved starts are most valuable in case of extraordinarily deep threads or in heat-treated material.

Blank design

In designing a worm thread for rolling, certain allowances should be made. First, the minimum active length of worm thread must be determined, because that will be the minimum length of full-depth rolled thread to be produced.

Worm threads to be rolled fall into four types:

(a) Where the adjacent shaft journals are smaller than the minor diameter.

(b) Where an adjacent shaft journal must be larger than the minor diameter but an undercut smaller than the minor diameter may be interposed between thread and shoulder.

(c) Where an adjacent shaft journal must be larger than the minor diameter and no undercut is allowed.

(d) Where the thread must be rolled between shoulders without undercuts.

In Fig. 5 at *A* and *B* it is plain that the workpiece thread exits from the die thread. Hence, the type of die chamfer or start relief is relatively unimportant. The thread face of the die can overhang the thread length on both ends, so that the die-thread starts does not come into contact with the workpiece material.

At *C* and *D* the die-thread start engages the workpiece material and participates in its deformation. Here the die thread must exit from the workpiece thread. It is evident that in the workpiece a length of shallow thread must exist *at least* equal to the length of the die chamfer or start relief. See Fig. 6. This shows how the thread will be both shallow and of scant addendum within the chamfer area. In addition, while the rolled thread will be to full *dedendum* within the full-thread face width of the die, the rolled thread crest will fail to fill completely for a length ranging from ½ to 1 pitch inside the full-thread die face width, starting from the top of the die chamfer.

End-feeding will occur during the

penetration phase of rolling, but can be controlled to one thread pitch or less.

Therefore, in taking the foregoing into account when designing a worm thread to be rolled adjacent to or between shoulders, you should:

1. Determine the actual length of full worm thread needed and dispose this length symmetrically on either side of the operating centerline of the cooperating wormwheel.
2. Add the length of the die chamfer, or twice the length of the die chamfer if the thread is to be rolled between shoulders.
3. Add ½ thread pitch to each end of the thread length to compensate for scant addendum.
4. Add 1 thread pitch for end-feeding or axial travel of the workpiece during rolling.

In the case of a thread to be rolled between shoulders, the sum of these allowances will be the minimum distance between shoulders of the blank.

Where the thread is to be rolled adjacent to one shoulder only, the length allowance between the shoulder and the desired point of the complete rolled thread will be the sum of:

1. The die-chamfer length.
2. A length of ½ pitch for scant addendum.
3. A length of 1 pitch for end-feeding.

Item 3 is not always necessary. End-feeding may be virtually zero on threads of low depth ratio and low helix angle.

Thread blank chamfers

When the worm shaft design is such that the worm thread length can be contained within the die thread face, it is necessary to chamfer the terminal ends of the thread blank. See Fig. 7. The chamfer extends from the surface of the blank diameter to a diameter slightly smaller than the minor diameter of the thread.

This modification is necessary for two reasons. First, if the blank terminal is square or of high chamfer angle, the lateral or transverse rupture force exerted by the workpiece material against the die thread is unopposed where the die thread emerges, and it will likely be broken at that point. If the blank terminal is chamfered, the workpiece force is counterbalanced sufficiently to avoid breaking the die thread.

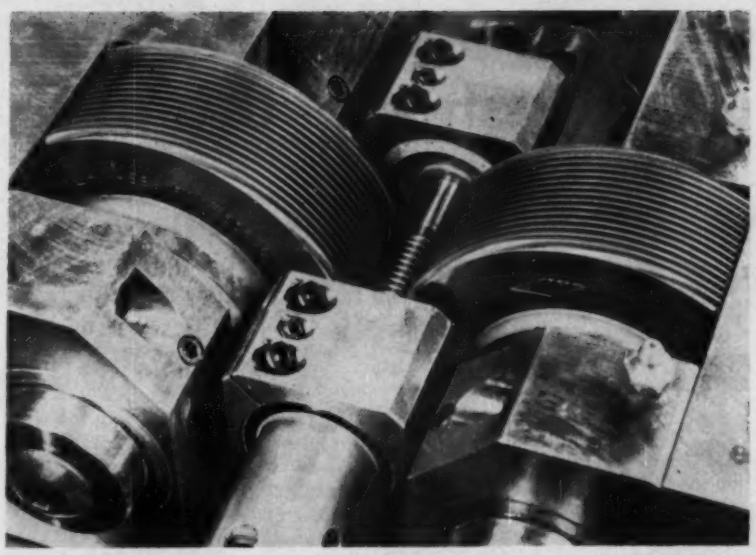
The second reason is this: where no chamfer or a high-angle chamfer is employed, material will be furled out from the rolled thread terminal. Results will be bad appearance and possible interference with adjacent members of the mechanism, such as bearings and spacers.

The conventional blank chamfer angle is 30° per side or 60° included, but lower angles are better where design limitations permit.

All the foregoing design pointers have been presented with infeed rolling in mind; that is, where the dies advance radially into the workpiece.

Many worms can be produced rapidly and economically by the throughfeed rolling process. Here, the dies remain at fixed center distance while the workpiece feeds axially through the rolling zone between them in long bar lengths.

The worm shaft can then be machined from the threaded bar stock. In many cases the shaft hole is drilled in the worm and the worm parted from the bar in an automatic screw machine, to be pinned or otherwise affixed to the shaft on which it is to operate.



Small tool-adjusting worm, Part F, page 108, is advanced to rolling position and removed after rolling by a retractable spindle in the workholding fixture

Choice of worm material

In general, any material with an elongation in excess of 12% can be rolled. However, it would be safer to say that in materials of sufficient ductility to be plastically deformed, 32 RC is the maximum practical hardness for worm thread rolling. Much better success will be experienced, particularly in terms of die life, if the maximum hardness is 25 RC. It must be borne in mind that appreciable work-hardening results from rolling, sufficient in many cases to eliminate heat-treatment

Further, the economy of rolling preparatory to carburizing, or hardening and grinding, where high hardness is required, certainly should not be overlooked.

Much study is being made of work hardness, ductility and wear life. Worms rolled of 1040 and 1045 have outworn worms cut from soft material better than four to one.

Generally speaking, 8620 has sufficient carbon to work harden properly in the rolling process, and is a good steel for rolled worms.

Sulfur content in any steel for rolled worms should be kept under 0.13%. Good steels for the purpose, and with sufficient machinability for other operations, are:

C1106	C1118
1108	1119
1109	1120
1110	1125
1114	1126
1115	1132
	1137

The C1132 and C1137 steels contain manganese, which is excellent for increasing work hardening and durability.

Frequently, the steel used for cut worms is C1144, hardened by a draw pass. The sulfur range of this steel is 0.24-0.33%, which is excessive for good rolling characteristics. This steel will exfoliate when rolled, and is the reason why one of the low-sulfur steels listed above should be chosen. •

A faster way to process orders

Cut job shop red tape

By setting up standards for processing orders, and by simplifying paperwork, a major spring maker has slashed processing times as much as 75%. Here is the way the system works. It's applicable to any job shop that has to process a mountain of paper in the least possible time

By Tom Johnson, associate editor

Any company that gets 100,000 to 120,000 orders a year—every one of them different—must qualify as the most complex type of job shop. It is complicated enough simply to make what customers want, but the preliminary task of entering orders and processing other paperwork is just as herculean.

What often happens in such job shops is that paperwork pyramids, and the whole processing system becomes cumbersome and top-heavy. As a result, delivery dates get broken, competitors get future business, and profits get smaller.

Until recently, the widely separated plants of the Associated Spring Corp—the world's leading manufacturer of mechanical springs—operated under such data-processing handicaps. Today, thanks to radical paperwork-simplification setups at three of its thirteen plants (with more installations on the way), ASC can turn out an annual $50-million worth of springs in record time.

Two examples are striking proof of what systems analysis (only one part of the program) has done:

- At the Corporation's Wallace Barnes Div (Bristol, Conn) order processing used to take from three to five times the number of days that it now takes, from receipt of order until instructions reach the machines. This time was just for the engineering and paperwork. By simplifying procedures in the future, with new systems now being installed, the plant expects to reduce these times even further.
- Orders that come into ASC's new Gibson Div plant in Mattoon, Ill, and the Plymouth, Mich plant of the B-G-R Div, are processed in only two days.

Besides this impressive time reduction, and its salutary effect on delivery dates, there are other advantages of interest to any job shop that has to process a host of different orders in the least amount of time. For one thing, the new system halves the number of forms required. First-year savings on paperwork and clerical costs were more than enough to pay for equipment needed to put the system into operation. And further cost-cutting was made in departments directly affected by the new way of doing things.

Another important benefit: The paperwork system is as flexible as the company's products. It will work in shops with as few as 25 employees as well as it does in plants with over 1000 workers. Paperwork forms are basically standardized and can be expanded or contracted as desired. To ASC this flexibility is important, because its plants vary in size.

History of program

All this work simplification is chiefly the brainchild of Arnold H Sandstrom, systems manager of Associated Spring's Wallace Barnes Div. Assisted by systems analysts Robert Coratola, Frank Kaschak, and outside management consultants as needed, Sandstrom completed the Mattoon installation in 1959, the B-G-R installation last year. The system for the Bristol plant has just been completed.

In all projects, meticulous planning based on predetermined targets paid off handsomely. Reports Sandstrom: "In our analyses, we found that certain procedures in an organization like ours must be followed without change. But we also discovered that the operations of all our divisions can be pretty largely standardized, even where there are variations in the type of work and the plant size."

Before they could alter a single piece of paperwork, the systems analysts had to recognize these facts:

- Each of ASC's divisions has to make just about any kind—and any size—of mechanical spring a customer wants. Typical products: compression springs, extension springs, torsion springs, wire forms, spring assemblies, clips, spring washers, special fasteners. These might go into anything—from the smallest watch to large, heavy machinery.
- There is no inventory of finished goods, because each order is custom-made.
- Lead time is the shortest possible, for competitive reasons.
- Lot size can vary from one spring to millions.
- Nothing happens twice in a row, because every lot is made to customer specifications.
- Tooling changes are frequent, because of changes in material.

Once they had learned to live with these awesome problems, the analysts were ready to set up their program, first at the new plant in Mattoon, Ill.

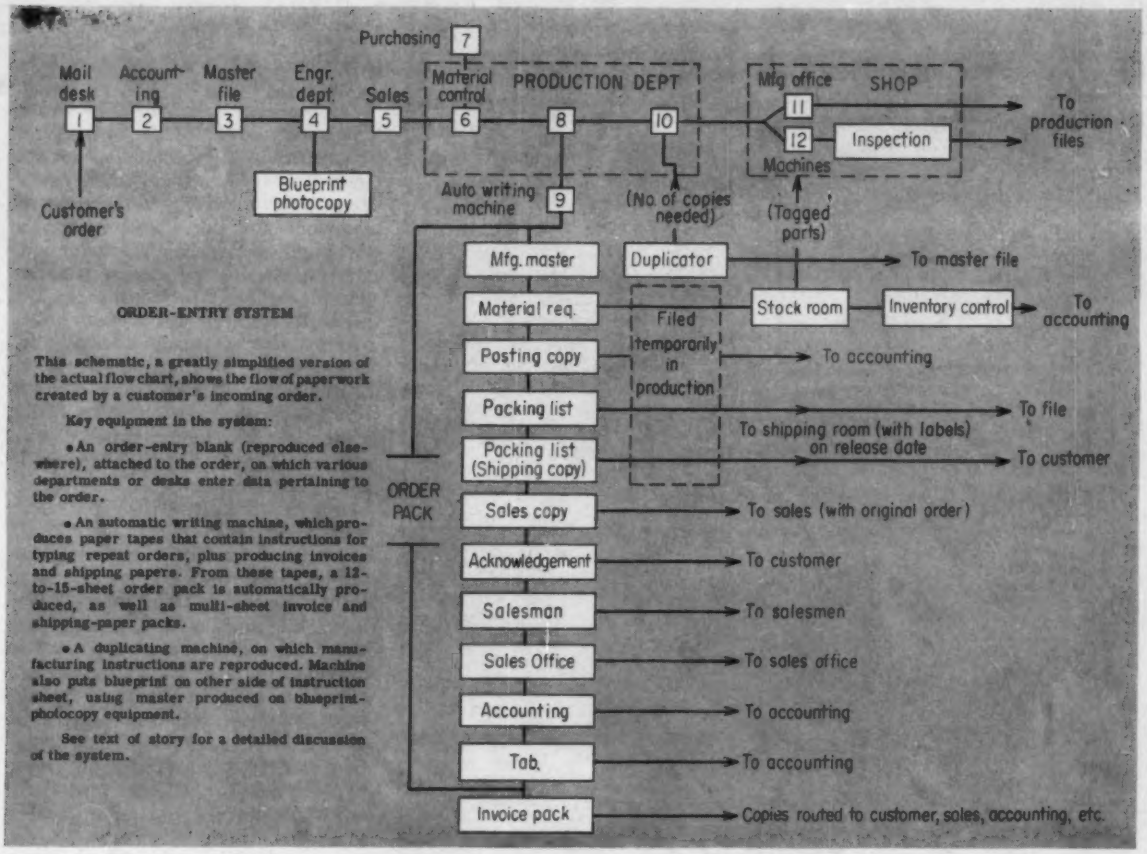
Setting up a system

ASC's new Gibson Div plant in Mattoon was a fortunate choice for the first work-simplification installation that the system-analysis group made. Because the plant was new, the three-man team didn't have to worry about replacing an outmoded system. As a result, it was able to work out a completely new arrangement—one that could serve as a model for future systems.

The actual work of conceiving, setting up, and installing the system can best be described as a series of seven steps:

Step 1—First the team established the *necessary functions* that principal incoming paper had to flow through to be processed. (Here "functions" refers to any department or desk through which paper might physically pass: mail desk, Engineering Dept, master files, Purchasing, Sales, and the like.) With the help of a functions flow chart, these functions were standardized as much as possible.

Step 2—The group now prepared a "functions and records consolidation chart." Here they consolidated some records and eliminated duplication, also reassigned functions wherever possible. A primary goal was to reduce paperwork by con-



ORDER-ENTRY SYSTEM

This schematic, a greatly simplified version of the actual flow chart, shows the flow of paperwork created by a customer's incoming order.

Key equipment in the system:

- An order-entry blank (reproduced elsewhere), attached to the order, on which various departments or desks enter data pertaining to the order.
- An automatic writing machine, which produces paper tapes that contain instructions for typing repeat orders, plus producing invoices and shipping papers. From these tapes, a 12- to-15-sheet order pack is automatically produced, as well as multi-sheet invoice and shipping-paper packs.
- A duplicating machine, on which manufacturing instructions are reproduced. Machine also puts blueprint on other side of instruction sheet, using master produced on blueprint-photocopy equipment.

See text of story for a detailed discussion of the system.

solidating records in the general office and eliminating clerical personnel in the factory.

Step 3—Now the team was ready to lay out and flow-diagram the office, fitting all functions and flow lines into the office space that was available in the new plant. To find the best arrangement, they prepared several layouts of the office, with the functions flow chart serving as a guide. Next the team created flow charts that showed the *paperwork flow* through the office, from mail desk to the files. These paperwork flow charts, drawn on translucent tissue, were placed on the layout.

At this point the group thus had a tentative picture of the flow needed to cover general processing of paperwork. Then the incoming paperwork flow, through the various functions, was drawn in. After making minor changes in the functions layout, the group had a system that would process the incoming paper in the shortest, most direct flow.

At this time the group also cooperated with plant engineers on the general layout of factory functions. Every attempt was made to set up shipping, receiving, and stockroom functions as near to the consolidated office function as physically possible.

Step 4—The group now got the answer to this question: How many people do we need to run the system? After careful study, the team arbitrarily selected a ratio of one non-productive (clerical) worker for every five productive workers in the plant. This number, although arbitrary and subject to later revision, gave the team a working figure for planning office design and layout.

Step 5—How much office equipment would be needed for capacity operation? To find out, the group created a dummy layout that established the number of desks and other equipment needed. Later, the accounting department used this layout when it ordered the equipment.

Step 6—Now that flow of incoming paper, as well as office layout, had been set up, the group turned to the *forms and flow of the internal paper and equipment* to process the incoming paper. Here it was important to standardize procedures, and to make the procedures flexible enough to fit the requirements of any Associated Spring plant.

Forms presently in use were gathered, as were suggestions from key personnel. The team attacked the forms, eliminating those that were not needed and reviewing the rest with the personnel who would run the system. Then as many forms as possible were consolidated, with emphasis placed upon the makeup of each (the number of copies, the wording, the layout, and so forth).

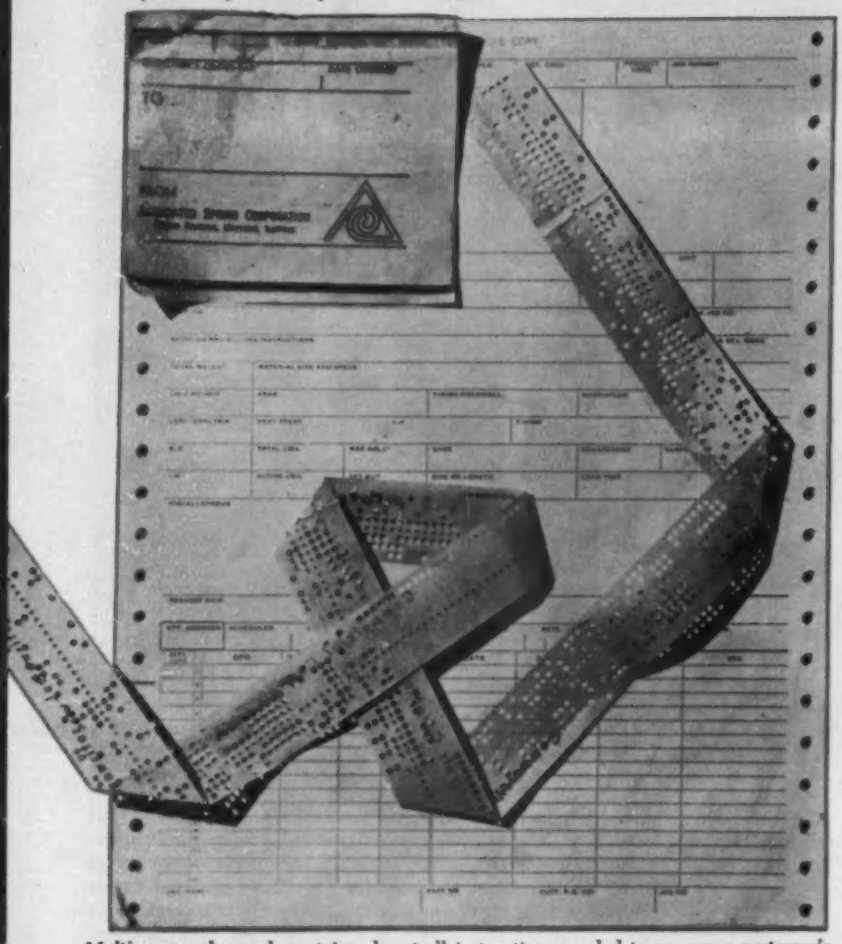
Step 7 — Final product of the group's work was an installation manual that shows all forms and instructions, as well as flow charts created for the use of the forms. With minor changes, the systems and forms in this manual can be applied to any of ASC's plants.

Actual installation of the system followed. The general office was set up. Special equipment was moved in: a duplicator, a photocopying machine, and an automatic writing machine. The team conducted eleven training classes in the use of forms, equipment, and paperwork flow.

Integrated processing

Three words best describe the system at the plants in Mattoon, Plymouth, and Bristol: standard, flexible, integrated. At all plants, all paperwork forms and flows are keyed to the most important process —the order-entry system, in which

Cut job shop red tape . . .



Multi-copy order pack contains almost all instructions needed to process a customer's order—right down to the stencil (upper lh corner) that Shipping uses. Pack is created automatically in minutes by feeding paper tape into automatic writing machine

the incoming orders are processed.

Let's look at the order-entry system. Actually, it is only one of many systems at work in the plants. Other paperwork systems, to name a few: price inquiry; sample approval; customer-order increase, decrease, or cancellation; shipping instructions; returned-goods mail; finished-goods inventory.

Each of these systems has its own procedures for handling incoming mail, plus the necessary procedures for taking care of internal paperwork that arises.

The flow chart reproduced on p115 shows the basic system created to handle customer orders that come into the Mattoon plant. In the step-by-step analysis that follows, numbers refer to the numbered boxes in the flow chart. The following discussion concentrates on major features of the order-entry system.

Paperwork flow

When a customer's order arrives at the plant's **mail desk (1)**, it is immediately forwarded to **Accounting (2)**, which checks the customer's credit. Then the order goes to the **master files (3)**. Here a folder is pulled, containing a case history of previous orders from that customer. The folder also includes blueprints and blueprint masters of previously ordered springs; a copy of an estimate and an estimate card that gives complete specifications on each previous job; and a record of prices and other data on each job.

Folders are, of course, filed by customer and part number—an important point here. Although each incoming order is a "special," re-orders make up a large part of the business.

(4) The Engineering Department. Now the order goes, with the folder, to the Product Engineering Dept. After checking to see that specifications and the order are complete, Engineering attaches an order-entry blank (see p117) to the order.

This order-entry blank, which accompanies the order and folder through the next few paperwork functions, contains space for entries by Engineering, Sales, Production, and Purchasing (if necessary). On the blank, Engineering fills in the product code (on new orders only) and job number for the order, plus total material weight and any specification or bogie changes.

If the order is new (that is, if the customer has never ordered the spring), Engineering has a photocopy master made of the customer's blueprint. And if the order has never been quoted to the customer, Engineering will initiate an estimate for pricing.

(5) The Sales Department. Now the folder and order go to Sales, which enters unit price, the plant's previous job number, and other information on the order-entry blank.

(6) Materials Control. Next stop for the paperwork is the Materials Control Unit of the Production Dept. After checking to see whether enough material is available to complete the order, Materials Control reserves the material for the job. If there is a shortage of material, then it is this group's responsibility to request outside purchase.

(7) The Purchasing Department. If stock is not available, the Purchasing Dept at once orders it, entering the delivery date and the purchase-order number on the order-entry blank.

(8) The Production Department. If enough material is in stock, the folder and order now go to the scheduling unit of the Production Dept, which schedules the job. Here Production must juggle several all-important factors: What are the customer's requirements? What is the plant's backlog of unfilled orders? When will material be available?

Once it has scheduled the order, Production enters two dates on the order-entry blank: (a) the date the order is to be released in the shop, and (b) the expected date of shipment to the customer.

(9) The automatic writing machine. At this stage the order-entry blank has been filled in and the job has been scheduled. Now the *internal paperwork* necessary to process the order must be created.

At this point—one of the most critical in the system—the analysts devised a remarkably effective way

to simplify and to standardize data processing. Checking past records, they discovered that many orders the plant receives are repeats of previously ordered springs. Thus, for repeat orders most of the data are constant. If these constant data could be automatically reproduced every time a repeat order came in, then only the variable data (price, quantity, spec changes, and the like) would have to be accounted for.

To create the new paperwork needed in the system, the group installed automatic writing machines, which are set up to reproduce automatically any instructions on a punched paper tape that is fed into them.

Here is what happens in actual practice: When the operator of a machine receives (from Production) the order-entry blank, folder, and customer order, she pulls the "repeat order" tape from the folder. This paper tape contains complete specifications, as well as other non-variable data, on the part. Now the operator puts the tape into the machine and also adds all variable data that have been listed on the order-entry card by Sales, Engineering, and other functions. The machine then reproduces from the tape a multi-copy order pack (see illustration, p116) as well as a multi-copy invoice pack.

The advantage of this simple setup is striking: *In a matter of minutes, almost all the paperwork needed to process the order has been completed.* And because most of the operation is automatic, posting errors and inaccurate transfers are cut sharply.

When the standardized order pack is pulled from the machine, it consists of several filled-in forms, each specially designed for a particular function (see the flow chart for a complete list of these functions). The multi-copy invoice pack, also prepared from a tape, is likewise ready to be distributed to various functions. If a partial shipment is involved, another set of multi-copy shipping papers is created with the invoice set, to provide for the next shipment.

Distributing the order pack is simply a matter of removing carbon paper and forwarding copies to the appropriate functions. As the flow chart shows, only one other paper-reproduction process remains: A manufacturing-master copy, produced with the order pack, goes to a duplicating machine, where as many copies of the manufacturing instructions as needed are made.

Treatment of instructions to the shop is one of the most interesting aspects of the system. To simplify paperwork, the analysis group wanted to put *all engineering instructions on one sheet of paper*—and it did. Manufacturing instructions appear on one side and the blueprint on the other. Because spring drawings are relatively simple, they can be reduced to an 8½-by-11-in. sheet without loss of detail. Incidentally, the Systems Dept had to reproduce all the plant's blueprints to make this phase of the program possible.

(10) The Production Department. From the duplicating machine, the manufacturing copies go to Production, where they are filed until the job is released to the shop. At the same time, other copies from the order pack (material requisition and packing lists) are temporarily filed in Production, where availability of tools and materials is checked. The posting copy is also filed, so that Production can check on the order at any time after it has released the manufacturing order to the shop.

(11) The Manufacturing Office. On the release date, the job goes on the shop's active schedule. The manufacturing copies go to the Manufacturing Offices, located in the shop. At the same time, Production releases the packing lists to Shipping.

(12) The machines. When the foreman receives an order, he begins to plan the job. On the day before the operation he calls for the material and checks to see that the proper tooling will be available. The job order then goes on a machine-loading board, notifying machine operators of the work to be done.

Meanwhile, the stockroom forwards material to the manufacturing area. Paperwork here is very simple: A tag is attached to each coil of spring stock sent to the shop. After the operation the foreman returns excess stock to the stockroom; or if all the material has been used, he returns the tag. The stockroom then notes, on the material-requisition form, the amount of stock used and sends form to Inventory Control.

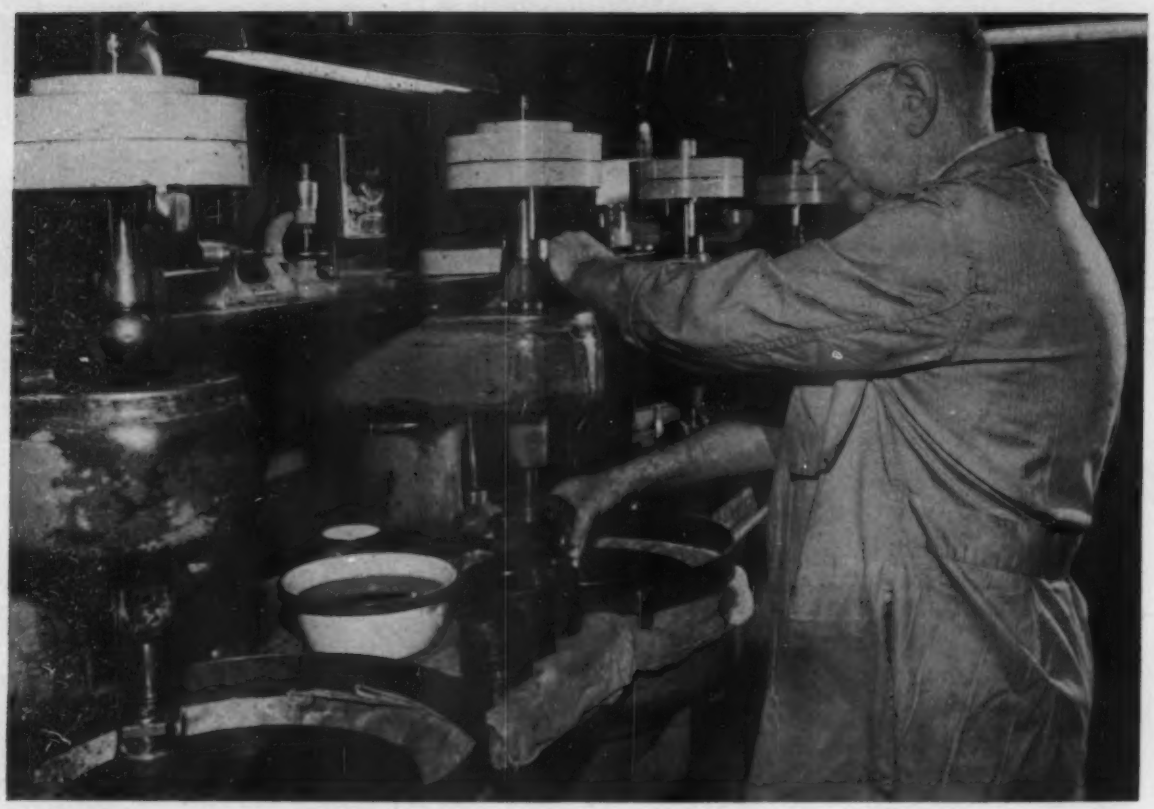
After the shop has finished the job, the remaining paperwork flow is fairly straightforward. Some forms from the order pack have already been sent to the customer, the salesman, Sales, Accounting, and so forth. A packing list goes with the completed springs to the customer's plant.

Other forms go back to Production, Accounting, and other departments for filing. In short, every function involved in the system is notified that the order has been completed. •

ORDER ENTRY BLANK

Dept.	
Acct.	CUSTOMER
	PART #
P. Eng.	PRODUCT CODE
	JOB NUMBER
Sales	UNIT PRICE
	PREV. JOB NUMBER
	CUSTOMER CODE
Purch.	STOCK IN INVENTORY ☐ STOCK ORDERED ☐
	P. O. NUMBER
	MATERIAL DELIVERY DATE
P. Eng.	TOTAL MATERIAL WEIGHT
	SPEC. CHANGES
Sales & P. Eng.	MISC. INFORMATION
Prod.	MFG. RELEASE DATE
	SPRING DELIVERY DATE
P. Eng.	BOGIE CHANGES

Order-entry blank goes with customer's order through several departments, which enter variable data (price, quantity, etc). Later these data are combined with non-variable data to create instructions for processing the order



Grinder removes stock in a cycle controlled by timer on bench and checked with horizontal and vertical micrometers.

Round weights on top of machine spindles are changed to adjust grinding pressure

Finishing to a microinch

The works of a watch always look impressive. That's because tiny parts are finished to "tenths" whether they need it for function or not. Here is how the industry keeps up appearances, even on the inside of a watch

By Eric H Sieke,
manager of production standards
Bulova Watch Co, Flushing, N Y

Watch factory finishing departments tend to be large and busy, and for good reason—to the watch industry appearance is just as important as quality.

For this reason, practically all parts are completely finished, whether they need it for function or not. Bulova, for example, finishes thousands of levers, yokes, pinions and even screw heads to ±0.0004 just for appearance, and to ±0.0001 in. if the dimension is functional.

Rotary lapping machines do most of the work, grinding off 0.0001- to 0.002-in. machining allowances, then lapping away a minor amount of stock to produce 1 microinch finish on many of these tiny parts.

The same machines do both operations, but with cast-iron or stone laps for rapid stock removal (30 seconds) or tin laps for slower (5-10 minutes) finishing.

In all cases, the abrasive is Linde A alumina powder with a particle size of 0.3 micron and hardness rated on the Moh scale at 9.

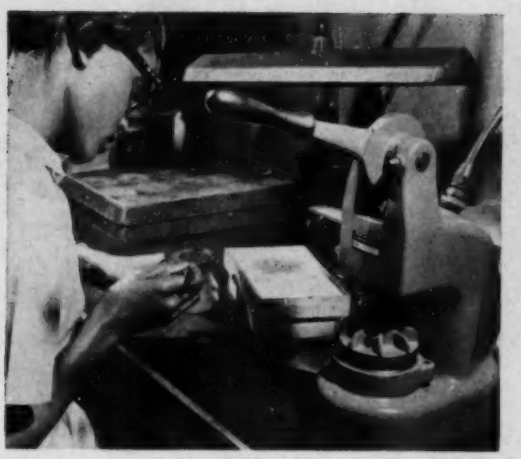
Time is the limiting factor at the lapping machines. Although the weights on top of each lapping spindle can be changed, the operation is usually controlled by a bench timer, which may also be rigged to reverse spindle rotation to equalize polishing marks.

Shellac is the clamping fixture. The parts are much too small to be clamped individually, so they are held on flat round steel blocks.

An operator heats a block, swabs on shellac from a stick, and places parts in several concentric rows around the OD of the block. Then she puts the block in a hand press to squeeze out the shellac from under the parts, leaving virtually none.

Shellac hardens around the sides of each part, and the thin layer underneath acts as a bond. The blocks are mounted in pairs on a lapping machine under dual spindles that rotate at 200-300 rpm. Pivots distribute the weight evenly so parts on both blocks are lapped down equally.

Bench equipment includes horizontal and vertical micrometers. The



Blocks are hand loaded with tweezers after they are heated and rubbed with stick shellac. Hand press squeezes shellac from under parts to create virtual metal to-metal contact

Double-spindle buffing machine removes burrs and improves finishes. Drive belts rotate the brush, rotate the blocks, and reciprocate the slide; a timer reverses rotation at controlled intervals

Miniature vertical lathe faces off cast-iron lap for flatness and parallelism. Grains in photo are CI chips.

Infra-red heaters dry tiny parts after ultrasonic cleaning and deburring. Heat clears liquid out of undercuts and small holes

vertical mike is for checking from the top of the part down to the surface of the block. The horizontal mike is for checking actual part thickness—a part is stripped from the block, gaged, and discarded if the dimension is not quite to specification.

Through practice, an operator can gage the required time roughly, thus may only have to make one or two measurements of the work before reaching final dimension. Each block is gaged in several places around the OD to make sure the lap is removing metal evenly.

Brushing technique

The same part-holding blocks may be set up for a deburring operation at dual-wheel brushing machines, to remove burrs and to polish flat surfaces (with the same Linde powder in paste form).

A timed motor belt-drives brushes, block-clamping spindles, and the table traverse, reversing rotation every half-minute or so to even out brush marks.

Some of these brushing cycles take up to half an hour. Timing and gaging are similar to treatment at the lapping machines, though much less metal is removed . . . usually less than 0.0001 in.

Cut gear teeth are finished by tumbling the gears to round off their edges, then finishing them down to the roots with a formed wood or fiber wheel. The abrasive is impregnated into paraffin or lamb-tallow sticks applied to the wheels.

Radii on pivot ends are lapped with elk or cowhide or felt taps loaded with abrasive. These operations are also time-controlled.

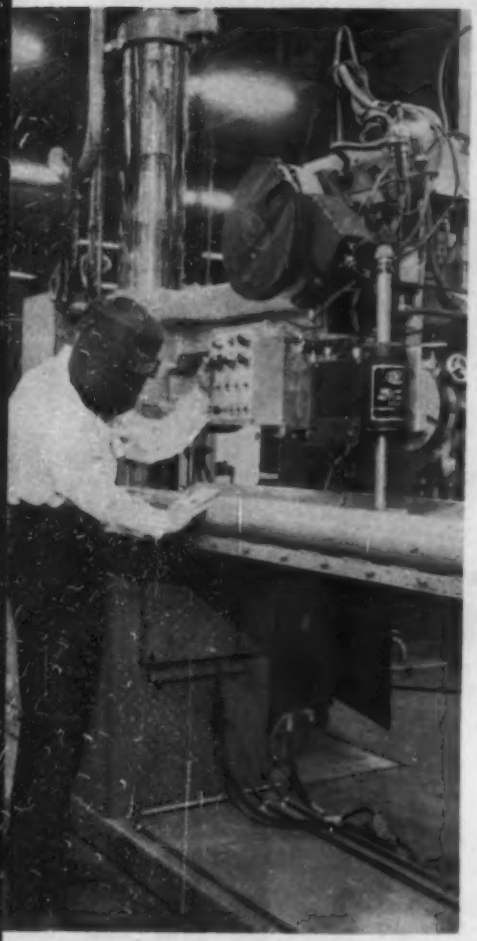
Cleaning

Parts are removed from the blocks by soaking them free of shellac with potash (potassium hydroxide) or alcohol. Then the parts may be self-tumbled in a soapy solution (depending on shape) or ultrasonically cleaned in perchlorethylene. Most of the parts would be impossible to wipe clean, so they are dried at an infra-red heating table, a batch at a time. From there, they move on to the assembly area. •

SHOP SHOTS

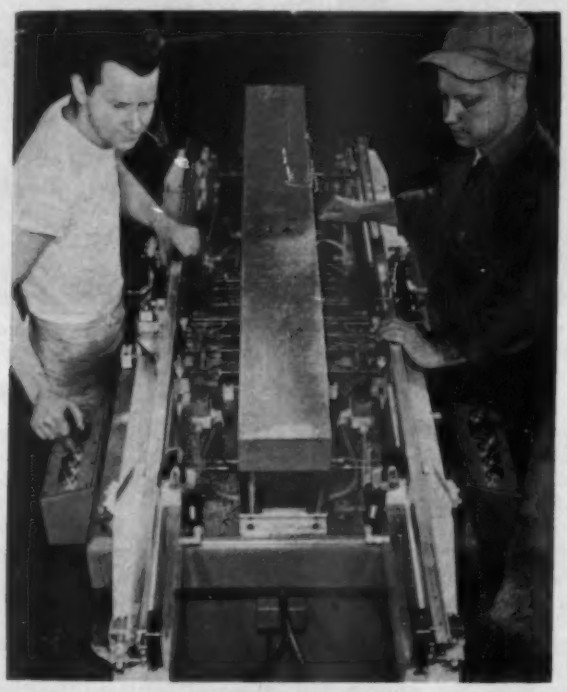
Bending stainless tube at Boeing

Big bending job at Boeing (Seattle) is 8-in. stainless-steel tube being formed to 90° angle on a Pines Engineering machine. The bender is the only one of its size, having been built to Boeing specs for 6-in. and larger tubing. The aircraft builder bends about 1800 welded stainless tubes/mo with wall thicknesses of 0.016 to 0.042 in.



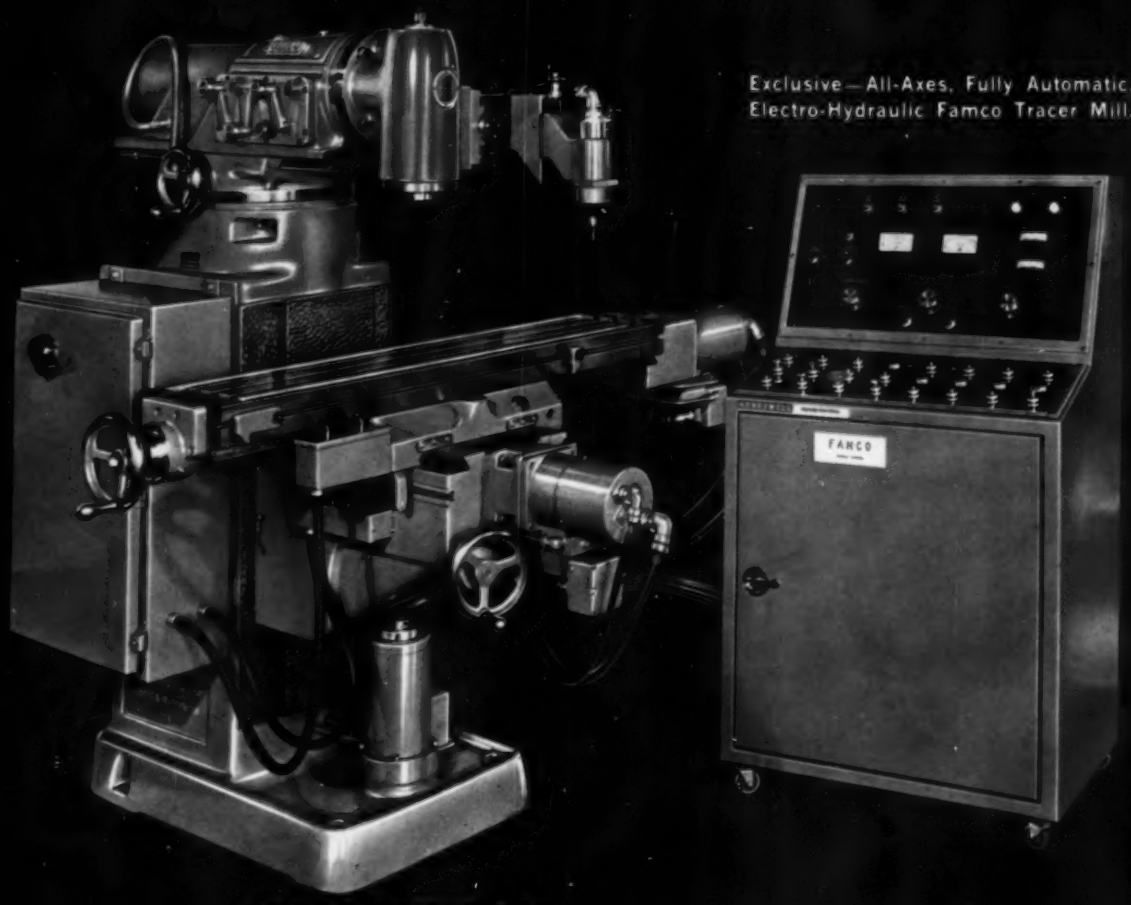
Seam welding at Temco

Automatic welder at Temco (Dallas) can produce seams up to 6 ft long at 200 ipm, and will follow wavy or angled contour with up-and-down head motion. The inert-gas, shielded-arc machine was converted to ac welding from a dc fusion seam welder for under $10,000. The head moves along the boom to weld the seam, while the torch holder can move vertically at up to 24 ipm to produce contours



Drilling metal doorframes

Frame-and-sash driller at Perma-Lite Raybern (Chicago) has two opposed and independent stations, 26 spindles, and interlocked controls that prevent drill breakage. Metal door or window element, such as a side rail, is positioned, then machine clamps, fast feeds, drills preselected holes, retracts tools, and unclamps in 5- to 15-sec cycle. Unit was built by I O Johansson Co, Skokie, Ill, for fast, flexible machining



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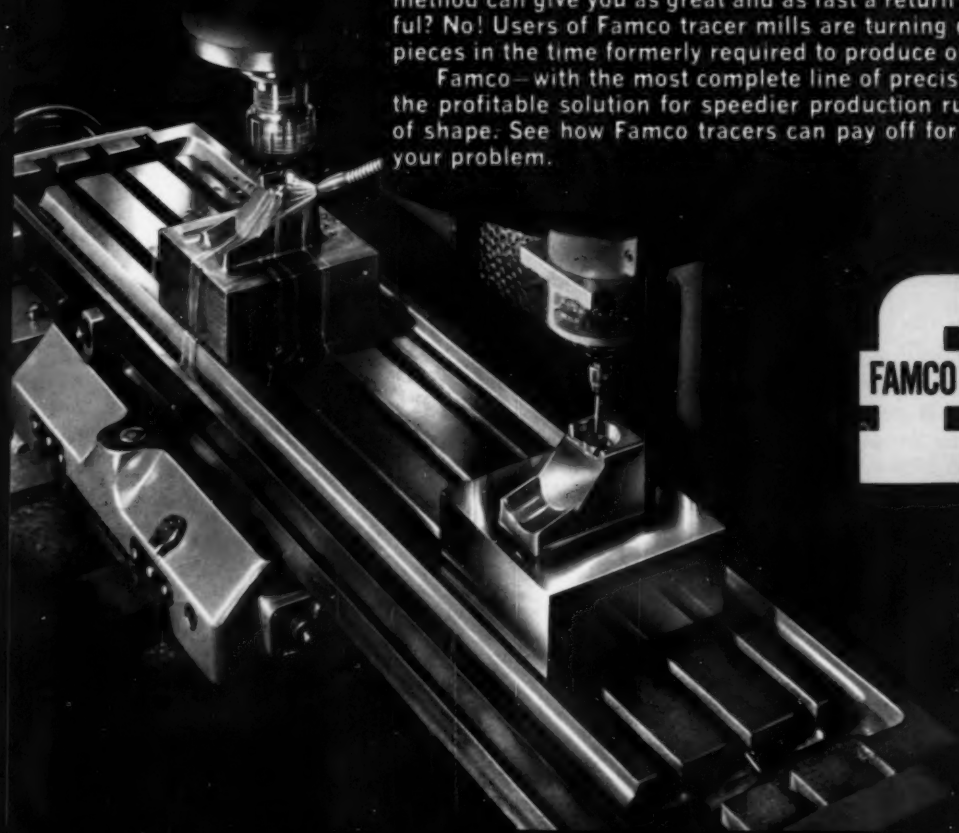

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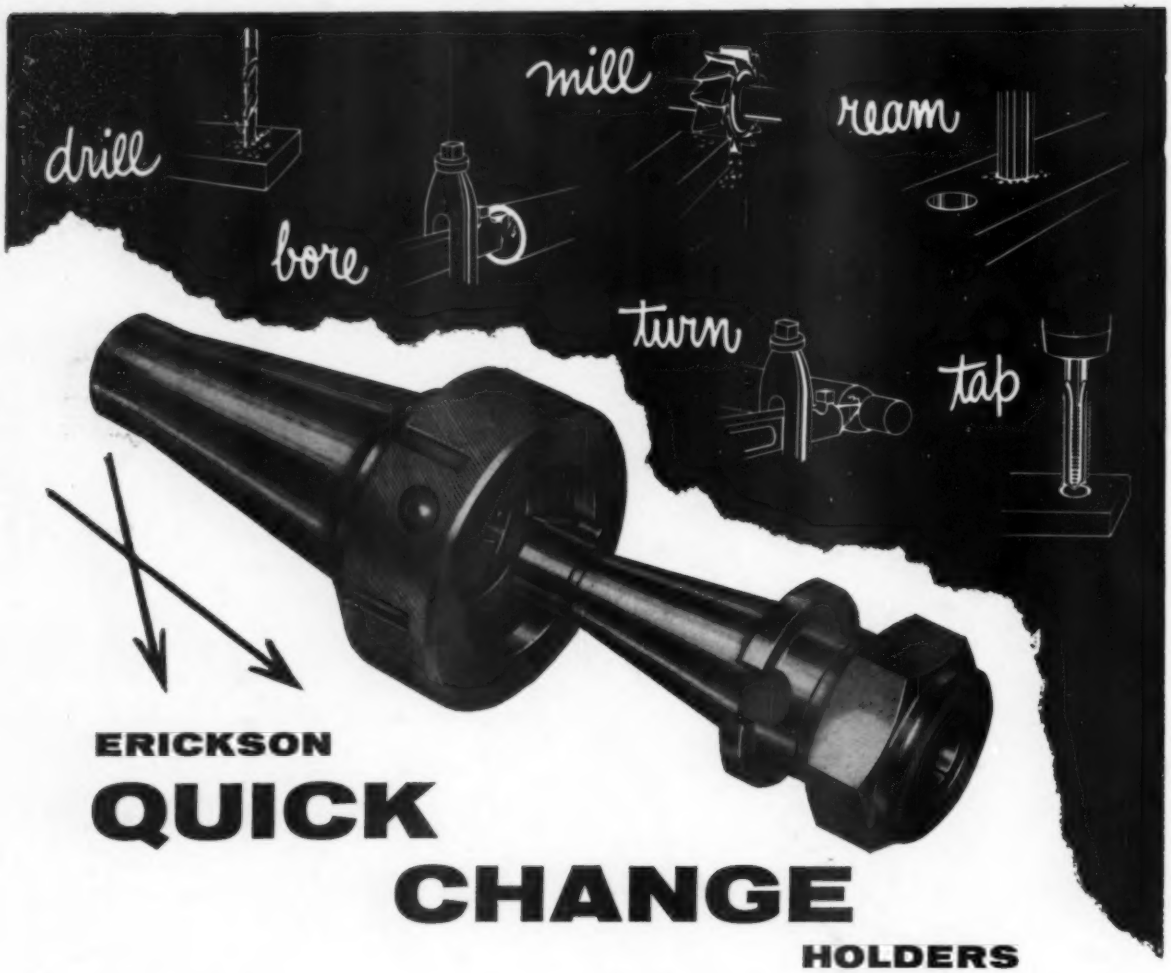

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REFERENCE BOOK SHEET

Laminated Plastics and Fiber—I

By John T Bishop, production manager, Continental-Diamond Fibre Corp, Newark, Del

Industry is using laminated plastics and fibre to save weight (about 40% of that for aluminum), to improve performance and appearance, and to achieve economies in fabrication processes and assembly. These materials are easily worked on conventional metalworking machines and woodworking equipment.

Nature of materials

The properties of a laminate depend on the resin-filler system used. Resins include: phenolic, Melamine, silicone, epoxy, polyester, fluoro-carbon. Reinforcing materials are cotton fabric, paper, glass fabric, asbestos, and synthetic fibers.

Vulcanized fiber is made up of layers of cellulosic paper, which have been fused by treatment in a zinc-chloride bath.

If the inherent properties of laminated plastics and vulcanized fiber are understood, these materials can be machined as easily as most metals, regardless of form—sheet, tube, rod, or molded.

Shear strength

Laminates have lower densities and generally lower shear strengths than metals. So, they can be machined on relatively light equipment, at high speeds and with low-cost tooling. Often it is advantageous to increase the machine's top speed capability.

Resilience

Both materials are resilient, which means that cutting tools must be kept extremely sharp. Otherwise, size control and finish will suffer. However, tolerances, comparable to those obtainable on metal, cannot be achieved even with the sharpest tools.

In punching and drilling operations, the materials tend to close in. Therefore, tools for these operations must be made over size, according to the material grade and thickness. Hole diameters in punching are affected by stock temperature. The diameter of hole actually produced will depend on whether the material is punched at room temperature or at some higher temperature.

Heating the stock has an important effect on resiliency. Punch diameters vary significantly for material punched cold as compared to stock punched after heating.

Low thermal conductivity

Laminated plastics and vulcanized fiber have low thermal conductivity as compared to most metals. Thus, it is important to make allowance for the fact that

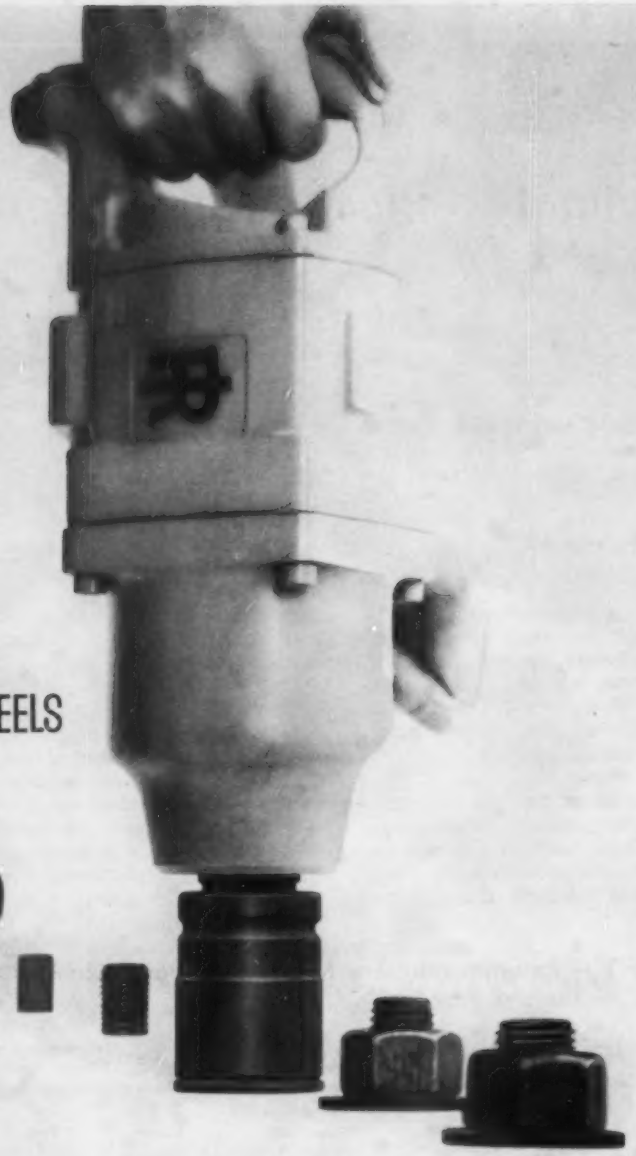
Table 1 — Recommendations for Turning Plastic Laminates

Military Spec	Type	NEMA Grade	Reinforcement	Resin*	Tool Angles ‡ Side cl., deg.	Cutting Speed HSS fpm	Cutting Speed Carbide fpm	Feed Rough	Feed Finish
P-997B	GSG	G-7	Glass Fabric	Silicone	7-10	300	550	0.003-0.005	0.003-0.005
P-997B	GSG	G-6	Glass Fabric	Silicone	7-10	200	550	0.003-0.005	0.003-0.005
P-3115B	PBG	XX	Paper	Phenolic	10-15	400	800	0.005-0.019	0.005-0.019
P-3115B	PBE	XXX	Paper	Phenolic	10-15	400	800	0.005-0.019	0.005-0.019
P-3115B	PBE-P	XXP	Paper	Phenolic	10-15	400	800	0.005-0.019	0.005-0.019
P-3115B	PBE-P	XXXP	Paper	Phenolic	10-15	400	800	0.005-0.019	0.005-0.019
P-8059		A	Asbestos Paper	Phenolic	10-15	400	800	0.005-0.019	0.005-0.019
P-8059		AA	Asbestos Fabric	Phenolic	10-15	400	800	0.005-0.019	0.005-0.019
P-8665A	‡	CF	Cotton Fabric	Phenolic	10-15	400	800	0.005-0.019	0.005-0.019
P-15035	FBG	CE	Cotton Fabric	Phenolic	10-15	400	800	0.005-0.019	0.005-0.019
P-15035B	FBE	LE	Cotton Fabric	Phenolic	10-15	400	800	0.005-0.019	0.005-0.019
P-15035B	FBM	C	Cotton Fabric	Phenolic	10-15	400	800	0.005-0.019	0.005-0.019
P-15035B	FBI	L	Cotton Fabric	Phenolic	10-15	400	800	0.005-0.019	0.005-0.019
P-15936B	GMG	G-5	Glass Fabric	Melamine	7-10	200	550	0.009-0.015	0.009-0.015
P-15047B	NPG	N-1	Nylon Fabric	Phenolic	10-15	400	800	0.005-0.009	0.005-0.009
P-17721C	GMM	G-8	Glass Mat	Melamine	7-10	200	550	0.009-0.015	0.009-0.015
P-18177A	GEE	G-10	Glass Fabric	Epoxy	7-10	200	550	0.009-0.015	0.009-0.015
P-18177	GEB	G-11	Glass Fabric	Epoxy	7-10	200	550	0.009-0.015	0.009-0.015
P-18324A	B		Cotton Fabric	Phenolic	10-15	400	800	0.005-0.009	0.005-0.009
P-19161	GTE		Glass Fabric	Fluorocarbon	7-10	200	550	0.003-0.005	0.003-0.005

Note: If you run into trouble machining glass fabric, leave 0.030 on diameter for finish cut. Then your feed can vary from 0.004 to 0.015 ipr.

† Side rake — 0°, end clearance, 5 — 7°, for all laminates

‡ Postforming type



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Laminated Plastics and Fiber—II

heat cannot be dissipated as quickly in machining these materials. In high-speed fabrication, either the material or the tool, or both, may be burned by the heat caused by friction. The cutting tool should be removed occasionally, permitting it and the material to cool. In some operations, tool damage and rejected pieces can be prevented by the use of lubricants or cold air jets. Carbide-tipped tools should be used wherever practical, because they retain a sharp edge at high temperatures.

Material structure

Because they are constructed of layers, laminated plastics and vulcanized fiber are weakest in the direction at right angles to their face. Where design will permit, drilling, tapping or broaching should be done at right angles to the laminations. Otherwise, care should be taken to prevent splitting, as by use of confining jigs or vises. In gear cutting, back the blanks with supporting collars to prevent delamination at runout.

Turning

Honed single-point tools are always advisable. Air-cooling is usually preferable, because liquids may be difficult to remove. Skived forming tools are used, but speeds should be increased on the softer grades.

Higher speeds are possible on thermosetting plastics than on thermoplastic types. Using high-speed tools, most laminates can be turned at 500-800 surface fpm. Table 1 gives detailed recommendations for tooling speeds for rough and finish cuts in turning laminated plastics. Carbide tooling permits double the best surface speed and is especially useful on asbestos or glass-base laminates such as NEMA grades G-5, G-6, G-7, G-10, and G-11. Cutting speed for carbide tools on glass-base laminates should be around 550 fpm.

Successful machining of vulcanized fiber depends on two factors: (1) a sharp tool and (2) plenty of clearance—at least 30°. Because it is extremely hard and tough, vulcanized fiber may crowd against the back of the tool, generating heat and dulling tools.

For light cuts and close work, diamond-cutting tools are best. For high-quantity production, high-speed steel, tungsten carbide or carbide-tipped tooling are used. Coarse cuts at speeds, feeds, and clearances about the same as those used on brass are best for this material.

Milling and planing

Milling and planing are relatively simple operations with laminated plastics and vulcanized fiber and need only normal care, sharp tools, fast chip removal, and quick heat dissipation. Dry cutting is the usual practice.

To prevent the cutter from lifting the laminate layers, climb milling is recommended. Surface speeds may be as high as 1000 fpm, with feed rates up to 20 ipm with carbide cutters. High-speed steel cutters require somewhat lower speeds and feeds. Cutters should have a 10° negative rake, with good clearance. Milling procedures are similar to those for brass.

Planing

Laminated plastics and vulcanized fiber may be planed or shaped at 70-90 sfpm with carbide tools that have up to 10° negative rake and about 20° clearance. For glass-base grades of laminated plastics, such as NEMA grade G-5, G-6, G-7, G-10, and G11 the speed should be 40-50 fpm with a feed of 0.010 to 0.015 in., a side clearance of 30°, a cutting angle of 36°, a cutting angle of 36°, and a shaving angle of 45°. Coolants are not necessary. However, an efficient pneumatic dust and chip-collecting system is necessary to prevent excess deposits of glass dust, which can cause dermatitis and other health hazards.

Forming

Use 0.002-0.003 in. feed when tolerance is less than 0.006 in. on any given dimension.

Use 0.003-0.006 in. feed when tolerance is more than 0.006 in. on any given dimension, providing the wall or diameter left is strong enough to support it.

Cutting off

Laminated plastics—Use 0.002-0.005 in. feed when burr is not permitted. If there is a second operation, which will remove cut-off burr, the feed can be increased tc 0.005 to 0.010 in., depending on width of cutoff tool.

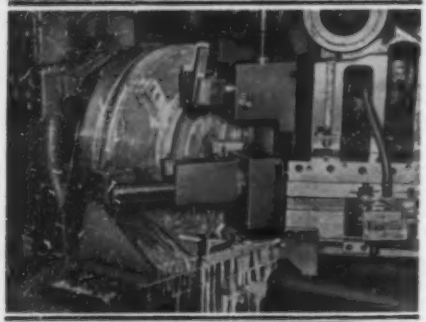
Vulcanized fiber—Use 0.001 to 0.003 in. feed to keep cut-off burr to a minimum.

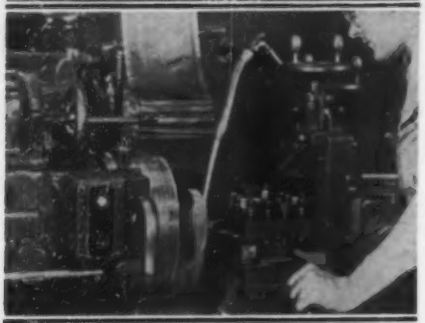
On all automatic screw machines, use carbide tooling and run at top spindle speed with exception of tapping; Then, run at 2/3 maximum spindle speed with a 3-1 ratio to withdraw the tap.

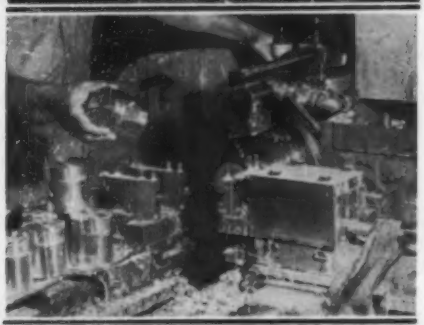
Table 2 — Feeds for Automatic Screw-Machine Work

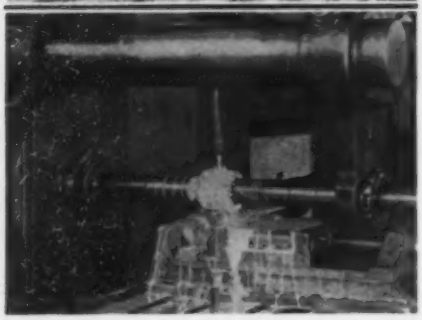
	Diameter	Feed, ipr
Drilling	0 — 0.125	0.001 — 0.003
	0.125 — 0.500	0.003 — 0.015
	Over 0.500	0.015 —
Turning	0 — 0.125	0.002 — 0.006
	0.125 — 0.500	0.006 — 0.015
	Over 0.500	0.015 —

Note: When tolerance is less than 0.006 in., use feed of 0.005 ipr; when tolerance is greater, use feed of 0.010 ipr.









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Old Couplings

COUPLINGS INSTALLED on a paper machine in June, 1921, are still in service after 39 years of almost continuous service. This came to light when West Virginia Pulp & Paper inquired about replacements of the Metal Products Div of Koppers. The couplings were made of cast iron, though forged steel has been standard for many years. In a day of squeezing costs, it is also interesting to note that the replacements will cost less than the original couplings.

Competition

A REPORT from Toronto says that two Australian drill makers are buying tool steel in Ontario, shipping it to Victoria where it is made into twist drills, shipping the drills back to Canada — and underselling domestic drills. The Australian firms are Frost Engineering and Patience & Nicholson.

Power-and-Free System

CONVEYOR SYSTEMS using the power-and-free method are used to an increasing extent where a high degree of mechanization must be combined with flexibility. We recall articles about them more than a decade ago in this magazine, but we suspect that not all our readers know just how they work.

In essentials a typical power-and-free system is a powered trolley combined with an unpowered monorail. Usually you have two tracks, one above the other. The upper track carries the powered trolleys with pushers extending down. The lower track carries load trolleys which ride freely but have pivoted dogs that can be raised to engage the pushers. Thus loads can be switched onto other tracks, or stopped, without stopping the power conveyor.

These thoughts were stimulated by reading about the power-and-free system Link-Belt has installed in the Chrysler stamping plant in Twinsburg, Ohio.

Quote

"THOUGH WE HAVE, in general, been walking ahead with progress in a dignified manner, and grown used to it, science now is pushing us along at a running pace, from which there is no escape."—James J Nance to the Cleveland Section of the American Welding Society.

50 Million Pins

COLD EXTRUSION of wristpins at Ford's Cleveland Engine Plant No. 2 was first described (*AM*—May 7 '56, p156) when the operation was new. Ford has just reported successful production of the 50 millionth part by the process.

Blanks are cut from bar stock in an automatic, phosphate coated, and extruded in a 200-ton press with carbide tooling. After extrusion, pins are carburized, quenched, drawn, centerless ground, and lapped.

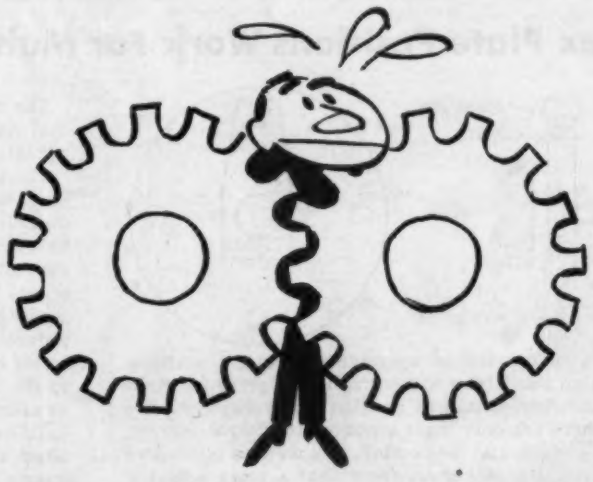
A second extrusion press has been installed since we described the operation and each press makes 2000 pins an hour. Now, say the people at Ford in Cleveland of the cold extrusion process, they see "expanding vistas of application."

Measurement Pinch

IMPACT of the "measurement pinch" on the aero and missile industries has been highlighted by a series of conferences sponsored by the National Bureau of Standards with the members of the Aerospace Industries Association.

At the meeting on internal diameters and surface flatness and finish there was a strong plea for development of measuring techniques based on entirely new concepts. "At present," says an NBS summary, "industry is being forced back into the medieval concept of hand craftsmanship."

In the meeting on gears, one company representative reported that for the first half of 1960, gears costing $54,000 had to be rejected by his company. This loss was the direct result of the absence of standard gear masters. In addition to these obvious losses, overtime operation at premium pay was necessary to fill the orders.

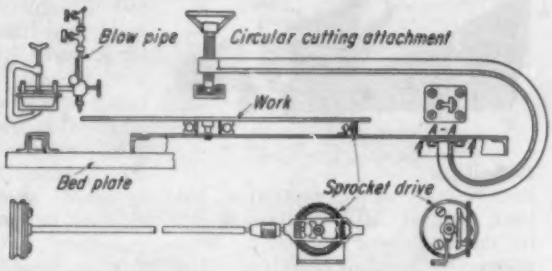


Practical Ideas

Work-Holding Rig Simplifies Flame Cutting

Just as a lathe stands ready to perform turning and boring operations, so is this rig available for burning steel plate, either on straightline work or (with an attachment) circular disks. It can be erected in the burning-welding department as a permanent fixture, or mounted on casters so it can be moved to any location required.

Supports for the rig are two A-frames, one at each end, which are joined by a channel iron and a pair of bars. The channel iron serves as rails for the blow-



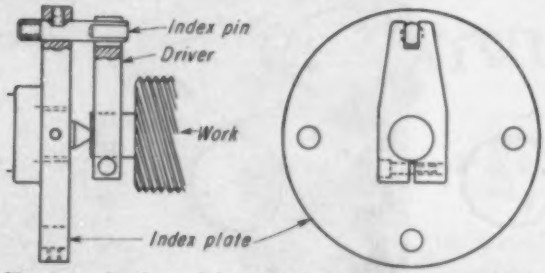
pipe carriage and the bars, being adjustable in height through a series of holes in the A-frames, support the bed plate. In addition, a pipe frame runs the full length of the rig and carries a small trolley to take the weight of the hoses and electric cable.

The bed plate is ⅜-in. thick, 3 ft wide, and 5 ft long with holes drilled and tapped at 2-in. pitch all over for locators and stops in repetitive work. There is also a back guide which, when adjusted to a certain width, is kept parallel with the channel rails by a bar on the edge of the bed plate. Parts having straight sides at various angles to each other are best laid out, either directly on the work or with the help of templets, and set up according to the layout.

The circular cutting attachment consists of a separate plate with a clamping arm to hold the center of the work. Resting on a large thrust bearing, on which it rotates, the work is gripped by a thrust-bearing-equipped clamping screw. A sprocket, which is fastened to an old hand drill, rotates the work under the blow pipe temporarily attached to the rail channel. Power to drive the sprocket is provided by the blow-pipe carriage through a pulley on a shaft gripped in the hand-drill chuck. Thus the work progresses as the forward end of the attachment rests on the bed plate.

R C Gordon, Bangalore, India

Index Plate Positions Work For Multiple Thread Cutting



Here's a simple and inexpensive way to cut multiple threads on short runs without using different positions on the leadscrew dial to position the workpiece. Because there are only three elements to control (driver, indexing plate, and index pin), this method eliminates any possibility of human error that a more complex indexing system would create.

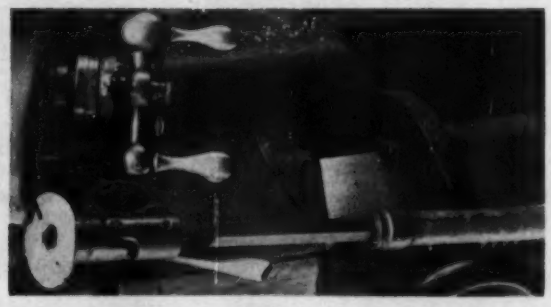
The driver is clamped to the workpiece by sliding the work through a slip fit hole in the driver, then tightening the screw which closes the clamping slot.

The index plate, which fits on the headstock spindle, has four indexing holes, set precisely at 90° (radial distance is arbitrary, but should be constant). The knurled index pin, which slip fits through the plate and into the driver, is secured in the plate by a set screw. Two flats on the end of the pin provide a wide landing surface for the slip fit into the driver—thus reducing the wear on pin and driver. Because the set screw bears on a notched surface that is at right angles to the flats, the operator merely tightens the set screw to align the pin flats with the driver slots.

To cut multiple threads, the operator cuts one finished thread with the pin set in one hole. Then he moves the drive and pin to another hole, and so on.

M W Loftus, Chicago, Ill

Powered Compound Improves Finish on Taper Work



Equipping the compound of our 21-in. lathe with a power drive saves us time and labor, and, above all, gives us a better product. We use it mostly, but by no means exclusively, for turning and boring the mating tapers of a friction clutch which connects a large drum with its driving gear. In this case, the angle is 36°, (beyond the range of the taper attachment) but in other instances, when the angle is less inclined, we find the powered compound handier to manipulate than the taper attachment.

The power takeoff is from a V-pulley on the end of the leadscrew to a counter-shaft unit clamped on the lathe bed. A few counterclockwise turns of a handwheel loosen the clamp enough to remove the whole unit and drive shaft from the lathe when they aren't required.

The drive shaft is made in two sections, a length of square steel and a piece of pipe, to effectuate the telescoping action necessary. And, to avoid machining a driver piece, a square-holed inner race from an old conveyor bearing is welded to one end of the pipe. The other end is then fitted with a universal joint which joins the drive shaft to the counter-shaft unit.

A second universal joint goes on the square-steel rod and carries a slotted coupling flange. This flange, flats on the compound handle, and two "quarter turn" thumb screws provide a means of quickly attaching and just as quickly disconnecting the drive shaft to and from the compound feed screw. Thus, the compound handle need never be removed from the compound in making the connection.

Travel-limit marks are scratched on the side of the compound slide, and the V-belt from the lead-screw pulley is kept moderately loose to prevent damage in case of over-travel. In engaging or disengaging the power feed if, for some reason small compound adjustments have to be made, simply disengage the lead screw or the selector tumbler. The direction of the compound-power feed is relative to the rotation of the leadscrew and is therefore controlled at the headstock.

H. Landauer, Tampa, Fla

Shaper Cutoff Tool Avoids Special Setups

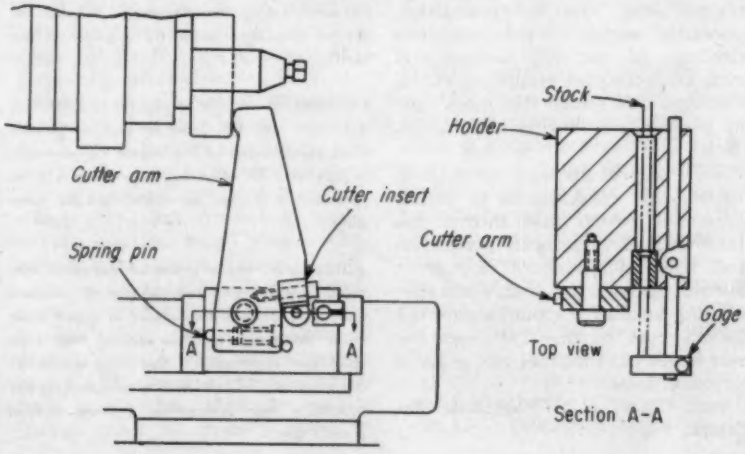
I never did like the common practice of setting up a shearing tool to cut off rod stock in a shaper. It has to be a special tool that takes time to make and adjust, and the machine is subject to heavy vibration. This tool will operate on any shaper, using much more of the shaper stroke to produce a mechanical advantage. This reduces shock.

All that's required is a cutting arm with a carbide insert and a spring return. The arm is pivoted close to the carbide bit, so a short tool stroke is produced by a considerable length of stroke of the shaper ram. Stops and adjustments are easy to work out.

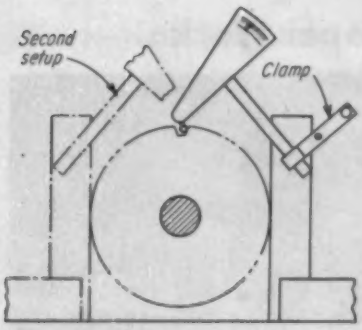
The cutter arm is contoured at the top to work from a tool blank or block in the shaper toolpost. There is only end thrust involved, so the shaper ram cannot be twisted or otherwise damaged. The cutoff tool is adjusted to work at the end of the shaper stroke, so the cutter arm never gets out of engagement with the toolpost block.

Different bushings can be installed in the tool body to take various sizes of stock for cut off. A length stop is included with its clamp screw. All of the pivots are socket-head capscrews; the stop pins are drill rod.

M W Loftus, Chicago



Practical Ideas



Quick Gear Setup

The quickest and easiest way to centralize a gear cutter over a gear blank before cutting is with a square and an indicator, as illustrated. You have to first take a trial cut, with the work centered approximately. Then you clamp the indicator to the square, bring the square up against either side of the round blank, and compare readings.

The easiest system is to set the indicator to zero on one side, then take a reading on the other side. You don't shift the indicator, because you want to pick up the near edge of the cut at the same height from each side. The amount the cut is off center is half the reading you get on the second side.

Another trial cut, after you've shifted the work a bit, should prove out your adjustment or show you how much more to make.

Frank Murray, Detroit

Warm Motors Won't Corrode

Moisture in our area, created by weather and also by production processes, seems to permeate the windings of our DC motors and bring on premature grounding of the windings. We notice this most over the weekends or during other shutdowns.

At easy way to prevent—or at least reduce—this condition is to install a manual switch that throws the shunt field of each motor across the line. The small amount of current flowing through the high-resistance winding keeps the motor warm, but doesn't cost much. The constant heat keeps out moisture and reduces corrosion losses.

Stan Clark, U S Phosphate Co, Tampa, Fla

Magnetic Base Clamps Vacuum Hose

We use an industrial vacuum cleaner to get rid of abrasive or powdery materials in our shop—often setting it up with the nozzle held as close to the tool as possible with a magnetic base and spindle rod—see photo. Constant exhaust from the machining area saves the bearings in our machines and keeps hazardous dust out of our lungs.

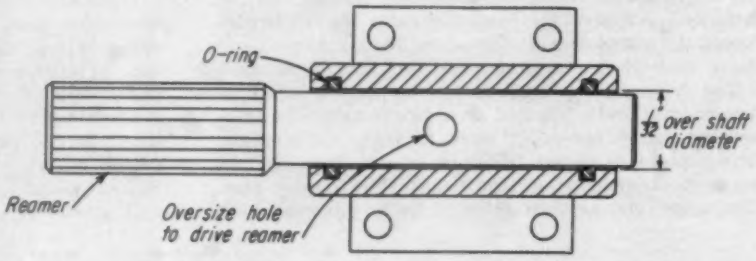
The magnetic base is easy to position, and the hose can easily be pulled away if the setup needs changing.

Norman Fried, Los Angeles

Reamer Assembly Aligns Itself

This reamer driver will allow for up to 1/32-in. misalignment with the work because the reamer shank is cushioned fore and aft by O-rings. A central hole through the reamer accepts a drive pin, which prevents rotation and provides end thrust. The unit is quite inexpensive.

Richard Prince, president, Prince Mfg Corp, Sioux City, Iowa



Henry E Piltz
East Orange, NJ
Won $25 for his idea:

Angle-Plate Insert Revolves
in the Nov 28, 1960 issue

AN EXTRA $25 will be paid for the best Practical Idea in each issue of *American Machinist/Metalworking Manufacturing*. Selection of the winning ideas made by a group of our readers.

PAYMENT—in addition to regular rate for item published—will be made as soon as tabulations are completed. The winner or winners—in case of a tie when duplicate prizes will be awarded—will also be announced in these pages.

JUDGES . . . are a group of *American Machinist/Metalworking Manufacturing* readers who select articles they prefer in a particular issue. This group changes entirely with each issue and represents a true cross-section of our readers. Their decision is accepted by the editors, without reservatons or bias, as final in each case.

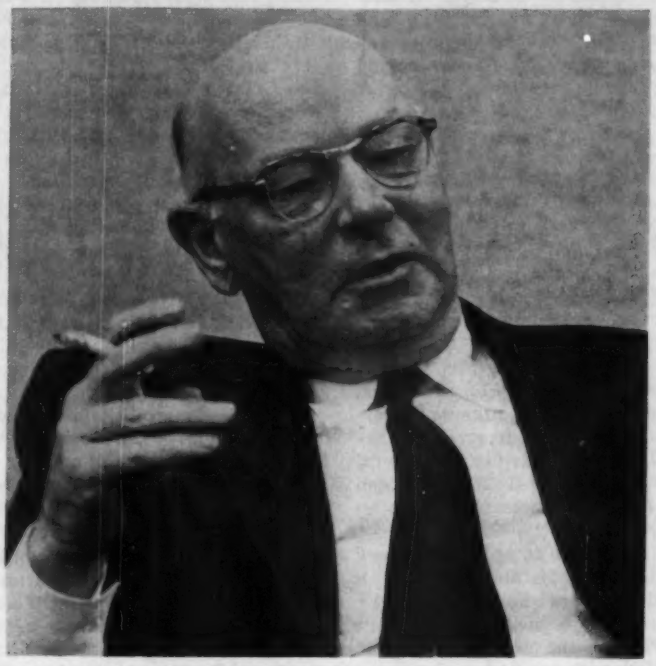
REQUIREMENTS—All items appearing in the Practical Ideas pages are eligible. They must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with *American Machinist/Metalworking Manufacturing* standards. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co. Inc, and those of its advertising agencies or departments. Suggest to your employes that they submit ideas.

HOW TO ENTER—Send all entries to: "Practical Ideas Editor" *American Machinist/Metalworking Manufacturing*, 330 West 42nd Street, New York 36, NY.

Adrian O Holmberg

An Austrian is said to have invented the gasoline-powered automobile, but it took a Henry Ford to realize its full possibilities. Someone else invented numerical control, but it has taken Adrian Holmberg of Chicago's Miehle-Goss-Dexter Inc to pioneer in its practical application. Today, he has taped nearly 20,000 operations on M-G-D's 22 machines, saving thousands of dollars by . . .



Putting numerical control to work

"By 1970, I'll bet that 90% of all machine tools will be built with tape controls."

Next to fishing, there's probably nothing Adrian O Holmberg likes to talk about as much as numerically controlled machine tools.

The 60-year-old executive vice president — manufacturing of Chicago's Miehle-Goss-Dexter Inc is secure in his role as a pioneer in putting tape to work in manufacturing.

No theorist he—Holmberg is a practical man who immediately recognized the potential cost savings in tape control. What's more, he has helped convince a number of machine tool builders over the last half-dozen years that they should put tape to work on their machines.

22 machines at work

Today, M-G-D has some 22 pieces of numerically controlled equipment in operation, and close to 20,000 tapes in storage.

Hundreds of manufacturing men have trooped through this printing press plant to watch tape-controlled machines in operation on a variety of parts.

"It's just out of this world what you can save," says Holmberg, "Why, in the tooling of three new products in our various divisions we have saved approximately $450,000 just on drill jigs and fixtures."

As a boy in South Bend, Ind, tape controls were about as far from Holmberg's thoughts as deep sea fishing off Acapulco, long since a reality. Son of a Swedish immigrant tailor, Holmberg was much too interested in tinkering with mechanical things to follow in his father's footsteps—although he has inherited a taste for good clothes.

South Bend was a burgeoning manufacturing town when Holmberg was a youth, and his mechanical bent quickly led him into machine shops during summer vacations from high school. He went to work at Studebaker's machine repair shop in 1922, after three years at Purdue.

Things were far different then—there were no anti-friction bearings, for one thing, and hand-scraping of bronze bearings was done patiently by hand by men who had learned the craft in Europe. Workmen had to change gears to chase threads on lathes. In line with this, Holmberg had to tear apart a vast variety of machine tools, and learn to run them all.

"I wouldn't take a million dollars for that experience," he says.

Working with tools did not occupy all his youthful years, however. He could sometimes be found at the baseball diamond, playing second base. And he found time, after being out of college a year, to marry Ellen Hagadone, a South Bend girl. They now have one daughter.

Drilling machine experience

After four years with Studebaker, Holmberg moved over to Sibley Machine & Foundry, makers of drilling machines. Starting as assistant superintendent, he took over the top manufacturing job six months later when the superintendent retired. In 1927 he became works manager. In the latter job, he built a topnotch dealer organization, still keeps a black book containing 39 dealer names in his desk. He thumbs through it occasionally, reminiscing fondly about some of his best dealers.

In 1941, Holmberg went into ma-

chine tool sales in Detroit, left after a year to join A O Smith in Milwaukee. And it was here that he met one of his most challenging manufacturing jobs—mass producing hollow steel propellers for aircraft by a unique welding process.

Up to that time, propellers had usually been machined from solid aluminum or steel forgings. By war's end, Smith was turning out thousands of blades each month on a conveyorized system.

Launches four divisions

Postwar, after starting up four manufacturing divisions for Smith —control arms, beer barrels, stokers, and rail equipment—Holmberg left to join a heating equipment company in the East but promptly returned to the Midwest as general works manager for Goss, which then had press manufacturing plants in Chicago and Battle Creek, Mich.

In 1953, Goss completed its new plant in Cicero, Ill, and combined all operations there. Four years later, Goss merged with Miehle, Chicago manufacturer of letter, offset and sheet-fed presses, under the name Miehle-Goss-Dexter Inc. The firm now operates nine plants in the U S, one in England, and one in Germany.

Holmberg was named executive vice president—manufacturing of M-G-D last year. As such, he is in charge of all company manufacturing operations worldwide—so it is readily understandable that he is a very busy man.

In 1951, Holmberg had his first glimpse of numerical control—a positioning table shown at the Tool Show in Chicago. He was attracted by the possibilities numerical control offered for eliminating jigs and fixtures, particularly because the printing press business is mostly small runs.

In fact, the more Holmberg saw of numerical control the more he liked it, and soon took the plunge by ordering two $10,000 positioning tables to be used with drillpresses for output of small parts.

The savings were great. From then on, Holmberg began to seek more ways in which to employ numerical control. He urged builders to put out more tape-controlled machines—this at a time when the Air Force and the big automakers were virtually the only buyers.

Today, Miehle-Goss-Dexter Inc has 22 tape-controlled machines already in operation and more on order. Holmberg wants to equip all standard machine tools with tapes.

"Numerical control isn't magic," he warns, "You have to do more than just order it. It takes very careful planning through industrial engineering and, later, practice to use tape. But the payoff can be tremendous."

Landing the big ones

For relaxation at his home in Western Springs, a Chicago suburb, he likes to putter around the house and garden, sometimes taking home movies. But chances are he and Mrs Holmberg will be plotting a fishing trip somewhere, perhaps to their favorite lodge in Northern Minnesota. Mrs Holmberg keeps right up with her husband in their battle to outsmart the fish, which they not only like to catch but eat, too.

"We eat the small ones and bring the big ones home to pass around," he grins. •

Westinghouse Electric Corp has elected **George L Wilcox** vice president and assistant to the president. Mr Wilcox has been president of Canadian Westinghouse Co Ltd, Hamilton, Ontario.

Sperry Products Co, Danbury, Conn, division of Howe Sound, has appointed **Ross S Peterson** product sales manager. He will be directly concerned with the company's Sonoflux line of magnetic particle inspection equipment. Mr Peterson was formerly associated with Magnaflux Corp.

Leland-Gifford Co, Worcester, Mass, has named **Richard E Quayle** manager of the Detroit office. Associated with the organization for the past 25 years, Mr Quayle had previously been a sales engineer in Detroit and, more recently, was manager of the Indianapolis office.

Standard Horse Nail Corp, New Brighton, Pa, manufacturer of machine keys, pins, and special steel products, has elected **G Blair Sheers** board chairman to replace the late **Fred I Merrick.** Mr Sheers has been president for the past 18 years and will continue in this capacity as active head of the 89-year-old corporation.

Tool & Die Institute, Chicago, has elected **Charles Zapf** president. Mr Zapf is secretary of Chas Zapf & Co, Evanston, Ill. **Paul Prikos,** president of Prikos & Becker Tool Co, Skokie, Ill, has been named vice president of T&DI.

Simpson Electric Co, Chicago, has appointed **Charles R Billman** vice president, manufacturing. Mr Billman was formerly assistant to the president and general manager of H K Porter Co's National Electric Division.

Taft Peirce Manufacturing Co, Woonsocket, RI, has elected **F Steele Blackall III** president to succeed his father, **Frederick S Blackall Jr** who becomes board chairman, treasurer, and chief executive officer. The new president has been associated with the company since 1949

Crane Co, New York, has appointed **Vernal C German** general manager of the Cochrane Corp, Philadelphia division. Mr German was previously sales vice president of the Cochrane Division in Toronto.

Cooper Alloy Corp, Hillside, NJ, has named **Herbert J Cooper** president and chief executive officer of the corporation and its subsidiary, Vanton Pump and Equipment Corp Division. Previously executive vice president, he succeeds **Harry A Cooper,** founder of the firm, who will now serve as board chairman.

Driver-Harris Co, Harrison, NJ, producer of electrical alloys, has appointed **William A Marshall** assistant vice president and manager of manufacturing. Formerly assistant manager, he succeeds **Edward J Davies** who has retired.

Handy & Harman, New York producer of precious metals, has elected **M W Townsend** to the newly created post of executive vice president. He will continue as vice president, administration, and will also assume responsibility for sales.

Barker Engineering Co, Cleveland, has appointed **Robert J Brandt** sales manager of the Barker Milling Machine Division. He was a former owner and president of the North East Brandt Co, Branford, Conn

Threadwell Tap & Die Co, Greenfield, Mass, has appointed **Richard E Shaw** head of the Cogsdill Drill Engineering Department. He was formerly associated with the Union Twist Drill Co

Norton Co, Worcester, Mass, has named **Russell P Hook** chief engineer of the Machine Tool Division to succeed **Herbert A Silven** who has retired. **Stewart S Mader** replaces Mr Hook as machine development engineer

United-Greenfield Corp, cutting tool and hand tool manufacturer, has elected **Edwin W Zipse** president and chief executive officer, succeeding **Konstantin Kronwall** who has relinquished the presidency but will remain as a director and a member of the executive committee. Mr Zipse was formerly executive vice president. **Jack C Malugen,** who has been elected to that post, has been serving as president of the J H Williams & Co division, manufacturer of forged hand tools and commercial forgings.

General Motors Corp has named **Roland S Withers** general sales manager of Buick Motor Division to replace **Edward C Kennard** who was named assistant general sales manager in charge of the eastern half of the US with headquarters in New York. Mr Withers was previously general manager of the United Motors Service Division of GM.

Dana Corp has appointed **Von R Kaufman** to the post of manger of the Toledo Division to replace **John H Jones** who has been named assistant to the vice president in charge of manufacturing. Mr Kaufman has been president and general manager of Hayes Steel Products Ltd, Canadian affiliate of Dana in Merritton, Ontario, Canada.

Parker-Hannifin Corp, Cleveland, has elected **Robert W Cornell** to the newly created post of executive vice president. He was formerly vice president, industrial marketing.

Thomas Flexible Coupling Co, Warren, Pa, has elected **Harry B Cummings** president and **Nicholas Kay** senior vice president. Koppers Co acquired controlling interest in the company last month and will operate it as a subsidiary.

Consolidated Electrodynamics Corp, Pasadena subsidiary of Bell & Howell Co, has appointed **Willard F Bates** director of manufacturing for the new Data Recorders Division which combines operations of CEC's DataTape and Electro Mechanical Instrument divisions. Mr Bates was formerly factory manager at Ryan Electronics.

OBITUARIES

Roger N Heald, 64, former president of **Heald Machine Co** (now a subsidiary of **Cincinnati Milling Machine Co**), died Jan 24. He had been associated with Heald Machine from 1919 until 1955 and had served as board chairman since 1949.

LeRoy R Brooks, 49, president of **Tool Steel Gear & Pinion Co,** Cincinnati, died Jan 16. Mr Brooks was a former president of the American Gear Manufacturers Association.

Irving H Buck, 53, president of **Machine Tool Sales Co,** Dallas, died Jan 15. He had been president since Oct 1959 when the company was formed out of what had been a division of Tool Supply & Engineering Company.

Archibald M Main, 90, former board chairman of **Bath Iron Works Corp,** and dean of American naval architects, died Jan 18. He had been associated with the firm since its organization in 1927. •

Chicago-Latrobe, Chicago cutting tool manufacturer, and a division of United-Greenfield Corp. has appointed **Albert S Burgoyne** vice president and general manager

Illinois Tool Works, Chicago, has named **Harold Byron Smith Jr** manager of New Product Divisions. He was formerly general sales manager of the Fastex Division, Des Plaines, Ill

You can't beat steel chains for non-skid stops and starts

These steel chains have more "bite" and far out-last ordinary chains. Only after the hardened steel "lugs" or "bars" are worn down do the links begin to show wear.

Tires need the strong "bite" of steel for safe stops and sure starts both on slippery ice and snow. And steel chains have extra "bite" when they are reinforced with hardened steel lugs or bars welded on each cross-link. They last longer, too. Leading chain manufacturers rely on steel from Bethlehem.

Bethlehem makes nearly every grade of steel wire . . . for bird cages, upholstery springs, cold-headed products, woven-wire cloth, and welded products . . . to name just a few. Whether you need a special-purpose wire, a coated wire, or a general-purpose grade . . . you can call on Bethlehem for technical aid from experienced engineers. Simply get in touch with the nearest Bethlehem sales office or write to us at Bethlehem, Pa.

Steel for Strength
... Economy
... Versatility

Bethlehem Steel Company, Bethlehem, Pa. *Export Sales:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

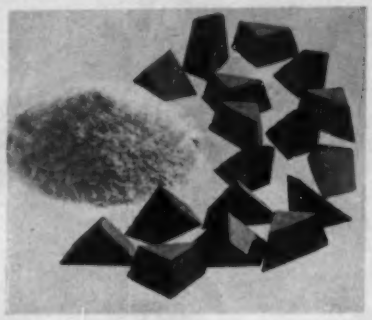
BETHLEHEM STEEL

CIRCLE 235 READER SERVICE CARD

Barrel Finishing Compound Holds Color

This new free-flowing soap-type burnishing compound, which is supposed to hold better color in barrel finishing zinc die castings, also maintains color on steel and most alloys, according to the manufacturer. The product in "Honite" brand 126 finishing compound.

When this compound is used with the Z-N honing shape (see cut) announced in 1959, it is said to solve problems encountered in finishing zinc die castings. The chips, which will not gouge the soft metal, also help retain color.



Frequently, a relatively small amount of the new compound can be used in the cutdown cycle; then, without rinsing the load, more compound can be added for the burnishing cycle. According to 3M, this saves one step in barrel finishing and lowers compound costs.

Minnesota Mining and Manufacturing Co, 900 Bush Ave, St Paul 6, Minn

MORE DATA? Circle 115, inside back cover

Grinding Coolant Reported Safe For Ferrous, Non-Ferrous Metals

Mill Stream, a new grinding coolant described by the company as "the perfect coolant for central system," can be used interchangeably for grinding ferrous and non-ferrous metals and also will not damage valves or other fittings in the coolant system. It grinds steel and cast iron without rust, and brass and aluminum without corrosion. Magnesium and ductile iron are the only metals with which the new coolant cannot be used.

The coolant is non-foaming even in high-pressure, high-capacity coolant systems; in addition, it is said to stay clean and keep wheels open so that they continue to cut to grade and grit size.

Serivce Products Div, Johnson's Wax, Racine, Wis

MORE DATA? Circle 116, inside back cover

Bronze Screw Machine Alloy Lists Advantages Over Bronze

Ampcoloy 668, a new leaded manganese bronze alloy suitable for high quality screw machine work, is a high-strength, free machining material available in extruded solid and hollow bar forms. Applications include: bushings, bearings, gears, cams, connecting rods, valve stems, lead screw nuts.

Compared to cast bearing bronzes, Ampcoloy 668 offers these advantages: close extruded tolerances reduce machining scrap; no hidden porosity; greater tensile strength (75,000 psi); decreased weight (8% lighter); corrosion resistance superior to copper-tin and copper-tin-lead alloys.

The alloy has good hot working properties and can be forged if closer size tolerances and higher physical properties are required. In addition, the uniform composition, temper, and lead dispersion permit duplication of established feeds and speeds and prevent excessive tool wear breakage.

Ampco Metal, Inc, Box 2004, Milwaukee 1, Wis

MORE DATA? Circle 117, inside back cover

Brick Stands Temps to 4200 F

Known as ICB 4200, a new ceramic insulating brick withstands temperatures to 4200 F. It is being formed in standard brick sizes of 2½ x 4½ x 9 in.

Among the properties of the brick is a mean thermal conductivity at 2200 F of less than 1.0. This is three times the insulating value of a 2600 IFB. The ICB 4200 brick has an 89% porosity and weighs approximately 2 lb per brick.

Ipsen Industries, Inc, Dept 721, PO Box 500, Rockford, Ill

MORE DATA? Circle 118, inside back cover

Epoxy Film Adhesive Aids Bonding In Making Honeycomb Sandwichs

Scotch-Weld structural film adhesive AF-106 combines the advantages of film adhesives with the self-filleting properties of epoxy adhesives. It is said to offer many design and cost-saving advantages for bonding metal and paper honeycomb cores to metal facings in honeycomb sandwich construction.

AF-106 provides uniform adhesive thickness through the assembly, controlled confinement of adhesive to the immediate bonding area, clean bonding operations and simple application procedures. Because the adhesive does not contain solvents, waste and shrinkage are avoided and solvent hazards and drying problems are eliminated.

The filleting properties of this epoxy film adhesive, which is available in varying widths and thicknesses and can be cut to fit the honeycomb assembly, eliminate the need for honeycomb core priming.

Other specifications include: metal-to-metal bonds with shear strengths of over 2000 psi at 75 F, high strength over service temperature range of -67 to 300 F, high peel strength and creep resistance under constant stress, excellent resistance to water, 20% salt spray, hydraulic oil, and aromatic fuel.

Adhesives, Coatings, and Sealers Div, Minnesota Mining and Manufacturing Co, 900 Bush Ave, St Paul, Minn

MORE DATA? Circle 119, inside back cover

2 Products Aid Die Casting

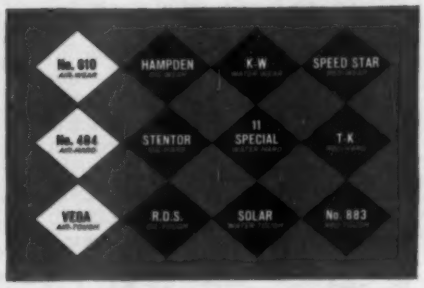
Two produced recently introduced—No. 7 high-purity zinc die casting alloy and 98DCZ high-purity aluminum hardener—are said to be "particularly beneficial" in maintaining the necessary magnesium and nickel content in low, but controlled, quantities. Composition of the alloy parallels that of other Zamak-7 alloys (*AM/MM*—Feb 6 '61, p121); the hardener is used in processing the Zamak-7.

Both products require meticulous care in their preparation to enable die casters to obtain claimed advantages over traditional Zamak alloys, the company cautions.

Apex Smelting Co, Chicago Ill

MORE DATA? Circle 120, inside back cover

But what about the RELIABILITY FACTOR in the selection of tool and die steels?



More output per grind . . . steady, high volume production at low cost . . . these are tooling benefits you look for on the job. They stem from the basic quality built into these three Carpenter MEL-TROL® Air-Hardening Tool and Die Steels . . . VEGA-FM, No. 484-FM, and No. 610-FM. Yet, good toolmen know that dependable performance hinges on still another factor: a sound, reliable way to select the right steel for each job. Here's exactly why Carpenter's Matched Set of Air-Hardening Tool and Die Steels gives you a tooling plus: You select quickly and accurately from just three grades to get the exact properties you need for almost any air-hardening application—maximum wear resistance (No. 610), maximum toughness (Vega), or a good combination of hardness and toughness in No. 484.

What's more . . . you know in advance that the steel you select will "deliver the goods". And realize, too, that these three steels are carried in ample stocks for quick delivery from your nearest Carpenter SERVICE-CENTER.

Carpenter steel

you can do it ***consistently*** better with Carpenter Tool and Die Steels

The Carpenter Steel Company, Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

CIRCLE 336 READER SERVICE CARD

Airco Electrodes Give Clean CO_2 Welding

A lightly coated electrode wire, which is the heart of the Aircomatic CO_2 Sprayarc process announced last spring (*AM/MM*—June 13 '60, p3), is now available in 0.045 and 0.054-in. diameters. The electrode lets the CO_2 shielded process make spatter-free welds in steel.

The A602 Aircomatic wire, as it is called, has a very light coating that controls current emission to produce a narrow, spray-type transfer of weld metal. Conventional welding equipment can be used with these electrodes.

The wire can be used for single or multipass mild steel applications with deposition rates varying from 7 to 15 lb an hr depending on size of wire and amperage. Tensile tests showed an ultimate tensile strength of 70,000 psi and a yield strength of 60,000 psi.

Air Reduction Sales Co, 150 E 42nd St, New York 17, NY

MORE DATA? Circle 121, inside back cover

Vinyl Coating Can Be Applied With Normal or Airless Sprays

A new high build vinyl coating Amercoat No. 99, can be applied with either conventional or airless spray equipment. The new coating is not a mastic, yet it overcomes the application disadvantages of most vinyls, which require multiple coats to achieve minimum protective thickness.

The coating, which has the same chemical, weathering, and physical properties of Amercoat No. 33, dries to a hard and tough matte finish that adheres firmly and resists abrasion. Non-flammable, odorless, and non-toxic, it will not harbor bacteria or fungi.

Amercoat Corp, Sough Gate, Calif

MORE DATA? Circle 122, inside back cover

Hot Punching Laminate Works In Severe Jack Spacer Applications

Panelyte Grade 825, a new hot punching laminate which exceeds XXXP requirements and has specially formulated high insulation and low cold flow properties, can be used in severe jack spacer applications. Sheets that are 6 x 48 in. come in thicknesses from 1/32 to ¼ in., natural color only, in semi or dull finish.

Typical mechanical properties for 1/16-in. thickness are: flexural, WG, A, 19,400 psi; flexural, AG, A, 14,500 psi; flexural modulus—1,000,000; tensile strength, WG, A, 12,400 psi; compressive strength, edge, A, 25,000 psi; specific gravity, 1.30; water absorption, 0.40%; cold flow and shrinkage, 0.35%.

Typical electrical properties for 1/16-in. thickness are: dielectric strength, perpendicular, S/T—650; V/M dielectric strength, parallels, S/S, A—70; KV dielectric strength, parallels, S/S, D48/50—20; KV dielectric constant, D 24/23—48; power factor, A — 0.032; power factor, D 24/23— 0.033; insulation resistance, C 96/35/90—375,000 megohms.

Samples for evaluation are available upon request.

Panelyte Div, Dept WMG, St Regis Paper Co, Trenton 8, NJ

MORE DATA? Circle 123, inside back cover

Grease Guaranteed Not to Burn

Belco No-Flame grease is a heavy-duty lubricant that is guaranteed not to burn, carbonize, corrode or melt, even under heavy loads. More complete details are available from the producer.

Bel-Ray Co, Farmingdale, N J

MORE DATA? Circle 124, inside back cover

Two-Component Plastic Filler Works Like Putty in 5 to 7 min

New polyester resin plastic filler and cream hardener, called Magic Bond, is black in color and is said to adhere firmly to metal, wood, plastic, and other materials. It will not rust, corrode, shrink, flake, chip, or peel, and is flexible enough to withstand heavy vibration without loosening or cracking.

The material, which is non-toxic and contains no fiberglass, works like putty and hardens in 5 to 7 min at room temperature. After 15 to 20 min, it can be sanded to a smooth feather edge and painted.

The two-component filler is available in half-pint, pint, quart, and gallon sizes.

Magic Iron Cement Co, Inc, 14215 Caine Ave, Cleveland 28, Ohio

MORE DATA? Circle 125, inside back cover

Fiberglass Cloth Laminates Deep, Sharp Contour Surfaces

Drapeze No. 391 (Volan finish) is a new fiberglass cloth that is said to ease in laminating deep, sharp contour surfaces. Although it is 0.0283 in. thick, it will form into and retain its position over a very sharp radius and deeply recessed area.

Developed with the cooperation of Rohr Aircraft, the No. 391 replaces 0.030 and 0.014-in. cloths which are difficult to form.

Because it uses a new weave, the cloth gives faster laminating, with fewer layers at lower cost and less interlaminar residual stress in sharp contour laminates. Applications include close tolerance plastic tooling, patterns and equipment, boat construction, and critical parts.

Rezolin Inc, 1651 18th St, Santa Monica, Calif

MORE DATA? Circle 126, inside back cover

Stripper Doesn't Attack Zinc

Chemclean No. 441B strips zinc-clad steels of paint without attacking the zinc. A mixture of strongly alkaline salts, used at 8 to 16 oz per gal at 180 to 200 F in a mild steel tank, the compound strips quickly and completely, leaving surface ready for immediate repainting without further treatment.

Chemclean Products Corp, 15-08 121 St, College Point 56, NY

MORE DATA? Circle 127, inside back cover

Graphitar Resists Oxidation, High Temps

A new grade of Graphitar (carbon-graphite), Grade 2573, has greater resistance to oxidation and high temperatures than grades previously available from the company. It is said to be ideal for parts that must operate in oxidizing atmospheres, such as air, at temperatures up to 1200 F.

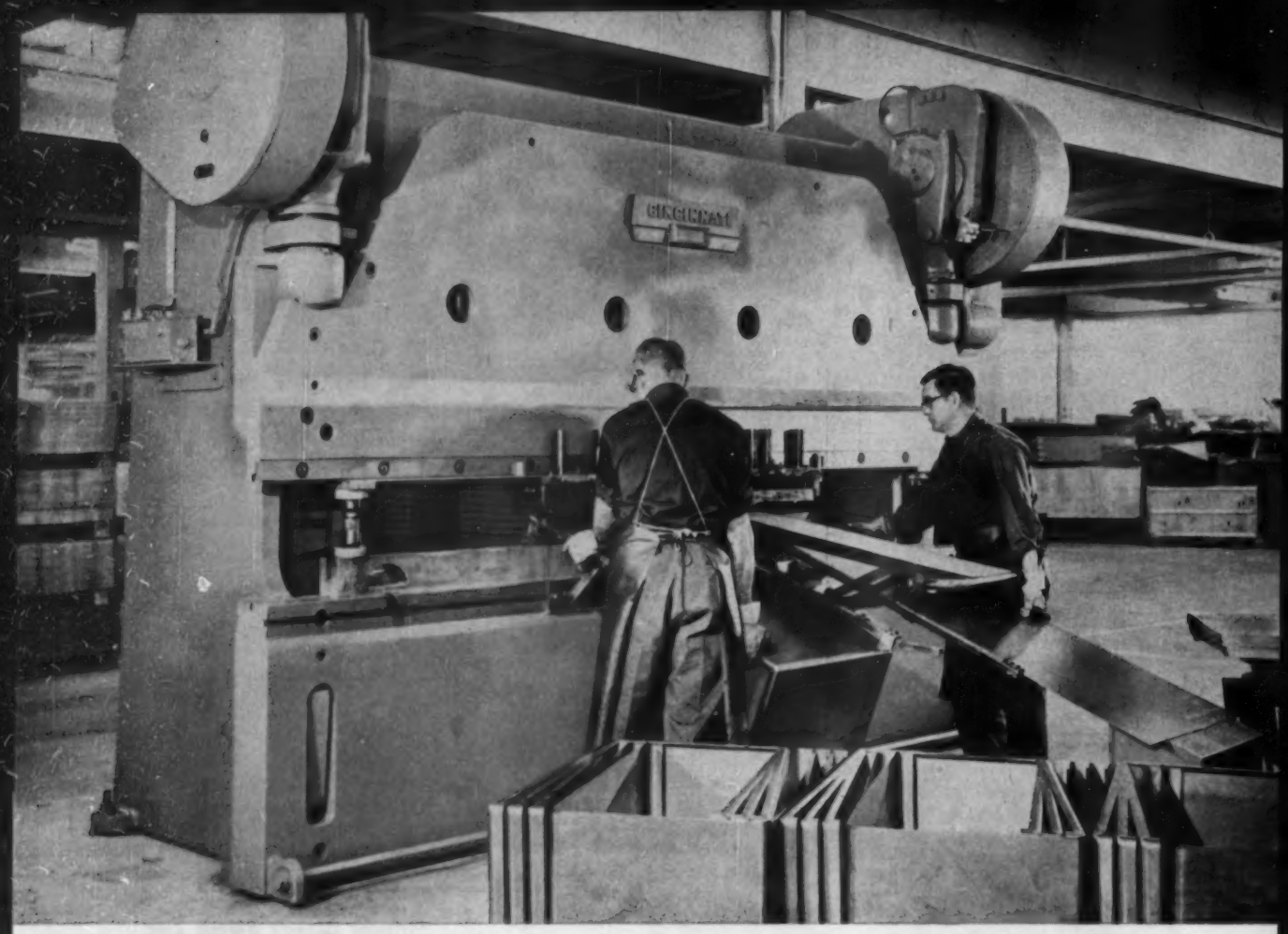
Other advantages listed are a lower coefficient of friction, improved wear resistance, and greater stability

Graphitar, which is available in many grades produced from graphite powers and a carbon binder, is compacted under high pressures and sintered at temperatures up to 4500 F. The material can be formed into intricate shapes, ground to tolerances of 0.0005 in., and lapped and polished within a few millionths.

Lighter than magnesium, harder than many steels, self lubricating, and chemically inert, the material is widely used for seals, bearings, end plates, valves, liners, bushings, and similar parts.

The United States Graphite Co, Div of the The Wickes Corp, Saginaw, Mich

MORE DATA? Circle 128, inside back cover



Efficiency jumps 50%

CINCINNATI® PRESS BRAKE FORMS PROFITS FOR STEELCASE

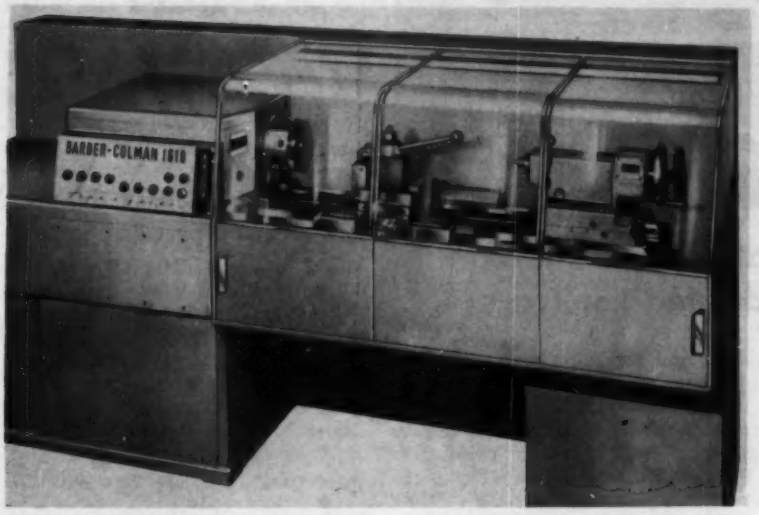
50% more efficient than previous method, this 225/150-ton Cincinnati forms four radius corners on pedestal bodies. "High degree of accuracy and convenient operation," according to Steelcase, help operators produce 80 pieces per hour. The machine operates more quietly and takes less floor space than their previous equipment.

THE CINCINNATI SHAPER CO.

Shapers / Shears / Press Brakes Cincinnati 11, Ohio, U. S. A.

In Scotland: The Cincinnati Shaper Co., Ltd., Glasgow

CIRCLE 237 READER SERVICE CARD



Barber-Colman Lathe Has N/C System That Eliminates Hunting and Turns True Tapers

Model 1610 Taper-r-guide lathe introduces a new approach to numerical control which is based on an idea called incremental tool travel; this system is developed around a direct mechanical linkage that eliminates hunting and the need for feedback information. The lathe cuts over 700 step-free tapers, with an included angle of from 2 to 172°, and can also do radii, cutoff and boring as well as internal and external step-turning.

System resolution is within ± 0.001 in. on length and diameter, although the machine itself is mechanically capable of even finer work.

700 tapers

New from the ground up, the 1610 works in increments of travel which are produced in direct response to taped signals. The tape reader fires solenoids that operate a system of clutches and differentials which pick off a variety of increments, that can be used singly or in combinations to cover any given distance on one command.

Feeds are coded (binarily, in 0.001-in. increments) between 0.001 and 0.031 ipr on each axis. Thus even allowing for duplication, the combination of X and Z gives about 700 discrete feeds for tapers—feeds which are continuous because they are mechanically geared together.

Input tape to the control system serves two purposes:

- It stores data to signify increments per revolution.
- Sprocket holes of the tape serve as a common denominator to define the distance between successive signals and coordinate the other axes.

Coding on the machine is different. Only one row of tape is needed for a complete axis command and, therefore, a few rows handle the complete command sequence. However, a low-cost translator converts other binary coded tapes into Tape-r-guide language. Thus, manufacturers can use this development without incompatibility with programming or coding procedures used for other numerically controlled machine tools.

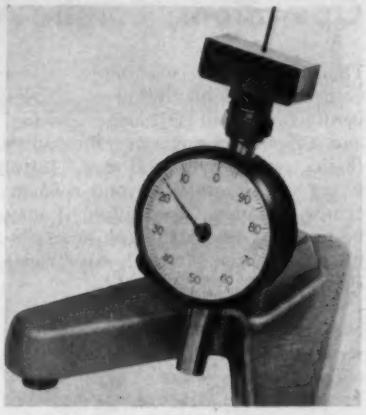
Centralized controls

All operating controls are centralized on the headstock panel, adjacent to the tape reader. Four dials are provided for pre-selection of spindle speeds which are actuated by tape commands at the proper time in the cycle. Another selector puts the machine into setup mode for incremental jogging of the cross-slide, or fully automatic cycling.

The lathe is designed and constructed to toolroom standards. It is available with swing capacity of 16 and 20 in., infinitely adjustable spindle speeds to 1200 rpm, rapid traverse of cross-slide and carriage, Meehanite castings throughout, and a central control panel for all electricals.

Barber-Colman Co, Rockford, Ill

MORE DATA? Circle 51, inside back cover



Small Hole Depth Gage Fits Any Hole Down to 0.062-in. Diameter

This small hole depth gage, designed for use with any hole or indentation inspection on parts where depth control is necessary, is direct reading from zero to one-half inch in 0.001-in. graduations. The contact will enter any hole down to 0.062-in. in diameter.

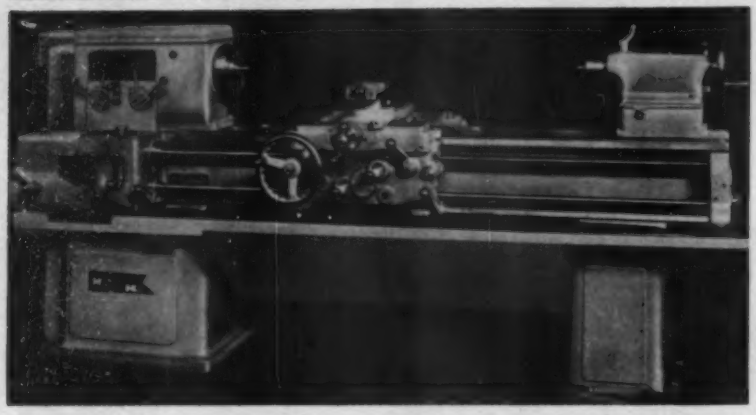
Although pictured here as a bench-mounted gage, the instrument may also be removed from the base and used as a hand gage.

Because it will hold any AGD dial indicator of groups 1 through 3, the three point support base may be used separately on special gaging applications. The indicator can be locked in any position from vertical to horizontal, depending on the requirement.

Three neoprene feet on the mount are said to prevent any slippage. In addition, they are supposed to guarantee a non-rocking, non-marring mounting.

Unigage Corp, 330 Interstate Rd, Addison, Ill

MORE DATA? Circle 65, inside back cover



Monarch's Kompact Lathe Does All Normal Operations, Can Be Adapted For Tracer

The Model K Kompact lathe—a low cost machine which handles all conventional turning, boring, facing, and thread chasing operations—has 16-in. swing over the bed, 10-in. swing over cross slide, and a 54-in. center distance. In addition, it may be used for tracer turning upon application of the Monarch Air-Tracer Pak.

The bed of the Model K is a heavily-ribbed, super-alloy casting with four flame-hardened and precision ground ways. There are 16 geared speeds in the range of 28 to 1200 rpm.

Precision type, tapered roller bearings support the precision spindle which has a 6-in. type D-1 hardened Camlock nose; headstock lubrication is automatic; the 5 hp main drive motor is mounted inside the cabinet leg. Drive to spindle is through balanced, multiple V-belts.

All US standards and US fine threads are included in the 48-thread range; fpr range is 0.0012 to 0.070 in.; end gear train is arranged to accept compound gearing for chasing odd leads.

The Monarch Machine Tool Co, Sidney, Ohio

MORE DATA? Circle 52, inside back cover

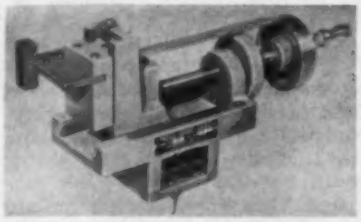
Line of Accessories Offered for Autosonic Ultrasonic Cleaners

Accessories for Autosonic cleaners (which tune themselves by means of a feedback transducer) include stainless steel baskets ranging in size from 6 x 9 x 10 in. to 24 x 18 x 16 in. Seven basic shapes, with dual handles, fit every size of tank in the cleaner line. Prices are from $32 to $69. Covers which eliminate undesirable odors and fumes during cleaning are also available for every size of tank in the Powertron 100, 200, 300, 700, and 1000-w series. These stainless steel covers, ranging in price from $12.50 to $27.50, also combat evaporation of solvents.

An ultra violet inspection lamp which detects materials missed by inspection with ordinary light is also available. Adaptable for bench mounting or hand grip use, it is priced at $110. An inspection hood with mounting frame is priced at $85.

Powertron Ultrasonics Corp, Patterson Pl, Roosevelt Field, Garden City, NY

MORE DATA? Circle 53, inside back cover



Press Brake Gage Has 75% Faster Setup and 0.001-in. Accuracy

Model 800 press brake gage is said to eliminate trial and error setup and, in actual time studies, has saved 75% in setup time. Horizontal adjustment with hand wheel at rear gives readings from 0 to 3½ in. on a scale at right side of gage. Vertical adjustment, to compensate for die height, is made by raising or lowering the front casting to desired height, and then locking with a set screw.

Micrometer gives fine adjustment horizontally in graduations of 0.001 in. In the casting, a ½ x ⅞-in. slot is provided for holding a magnetic sheet stopper, which is held in position with two set screws.

The gage is easily applied to any press brake by installing a ¾ x 2-in. bar of cold rolled steel over which the gage slides and is then easily locked in any desired position by two thumb screws.

Addresso Mfg Co, 9105 W King St, Franklin Park, Ill

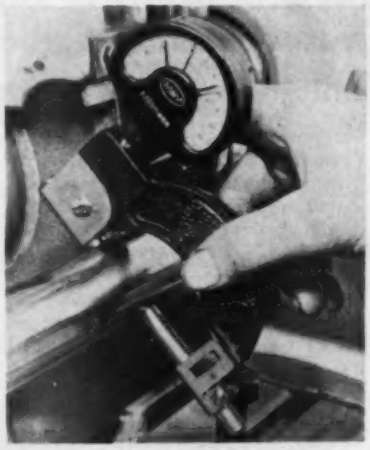
MORE DATA? Circle 54, inside back cover

Pneumatic Die Cushion Eliminates Power Press Pit Requirements

Model MC pneumatic die cushions, currently available in sizes from 8 to 16 in., are primarily designed and constructed for press bed mounting with the minimum overall height, eliminating the punchpress pit in most cases for a given power press.

Dayton Rogers Mfg Co, 2824 13th Ave South, Minneapolis 7, Minn

MORE DATA? Circle 55, insire back cover



Mahr Gages and Micrometers Read Direct to 50 Millionths

An adjustable snap gage (shown), which has an indicator reading in 50 millionths, comes in five sizes which cover a range from 0 to 8 in. One gaging head can be interchanged on all sizes. Because this gage eliminates "feel" of operator and substitues for this a direct indication of size, it is said to make go/no-go gaging obsolete.

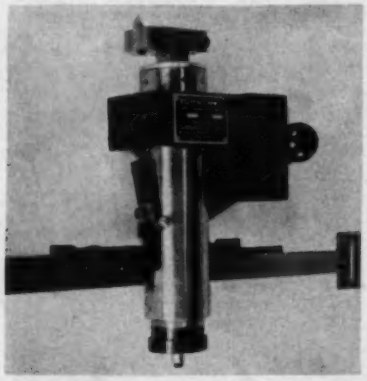
Gaging heads which read directly in 50 millionths, 20 millionths, and ½ thousandths of an inch are available; therefore, gaging heads with finer or coarser graduations may be readily interchanged at any time if job requires different tolerances.

Eleven different types of interchangeable anvils can be obtained for checking of small precision parts with the company's indicating bench micrometer. Tapered shank of anvils assures interchangeability within seconds, guaranteeing parallelism.

This measuring machine, with 1-in. measuring capacity, reads directly in 50 or 20 millionths of an in., since the comparator head is interchangeable. Micrometer thimble measures directly by 0.0001 in. and a thumb lever built into the base permits rapid retraction of anvil while inserting and withdrawing the work.

Mahr Gage Co, Inc, 274 Lafayette St, New York 12, NY

MORE DATA? Circle 56, inside back cover



Turnomat Copying Attachment Gives Accuracy to 0.0005 in.

Because this new copying lathe attachment is mechanically actuated, it will copy from template in tolerances of 0.0005 in. in one pass, with zero precision concentricity. The attachment will turn an almost unlimited variety of contours, radii, tapers and 90° reverse shoulders in unlimited lengths and diameters, including face turning.

Tool post mountings are available for all sizes and makes of engine lathes, screw machines, and boring mills. Templet service and pilot runs are available from prints submitted for cost estimate.

According to manufacturer, an unskilled operator can handle more than one machine.

Turnomat Co, Inc, Brockport, NY

MORE DATA? Circle 57, inside back cover

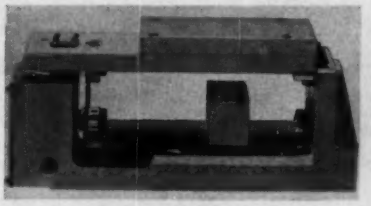
Collet Chuck Drives Broken, All Flute, and Shankless Drills

This tool has a driver plate which fits into flutes thereby giving positive drive action; collet simply maintains concentricity.

The chuck comes in three sizes. The 1000 series (lists at $30.50) has capacity of ¾ to 1 in. with 15/16-in. collet and choice of three extra collets. The 750 series ($25.50), has capacity ½ to ¾ in. with 17/32 collet and choice of three extra collets. The 500 series' ($20.50) capacity is 3/16 to ½ in. with 13/32 collet and choice of three extras.

Cal Chuck Co, 5016 W Burleigh St, Milwaukee 16, Wis

MORE DATA? Circle 58, inside back cover



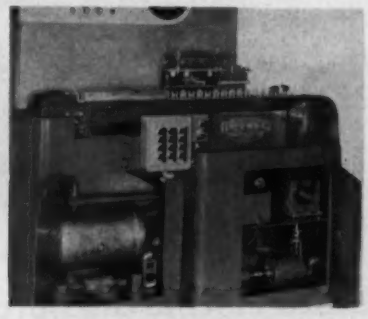
Force Transducer Handles Loads Over Range of 8 oz to 1500 lb

This force transducer is a fast-response primary element which automatically senses and measures varying amplitude forces (tension, pressure, weight, thrust, etc) for control purposes. Key to design accuracy of the mechanical-to-electrical transducer is a system of cross-spring (flexure) pivots combined with a flat cantilever main spring.

Standard models of this instrument can handle loads over an 8-oz to 1500-lb range. Special designs are available for loads up to 50,000 lb.

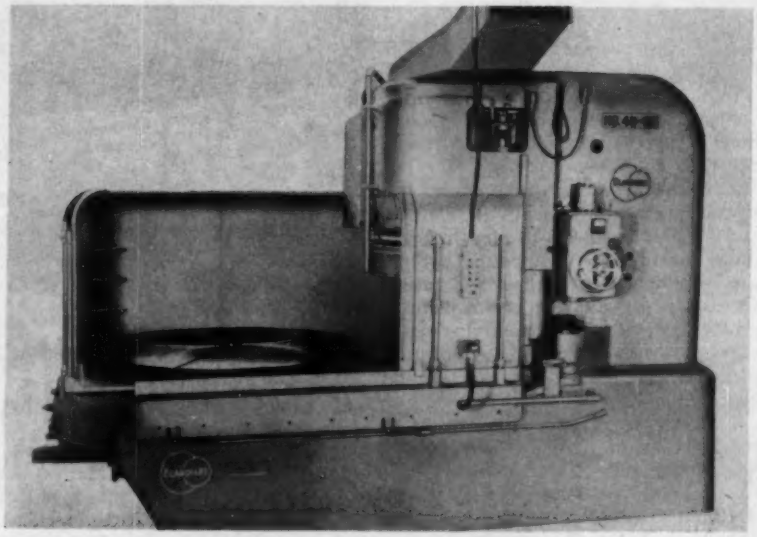
Hydro-Pneu-Tronics, Inc, 3666 E 116th St, Cleveland 5, Ohio

MORE DATA? Circle 59, inside back cover



AUTOMATED HARDENING EQUIPMENT processes 1800 rocker arms an hr for car and truck manufacturer. System will handle other jobs as well — *Induction Heating Corp, Brooklyn, NY*

MORE DATA? Circle 60, inside back cover



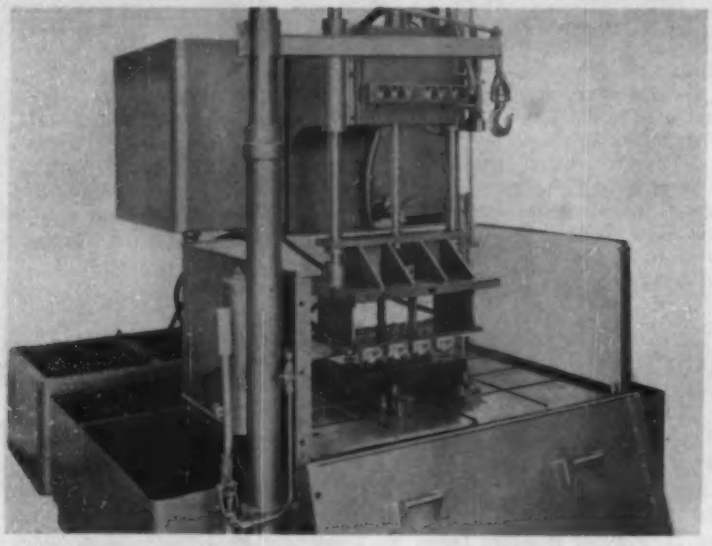
Blanchard Grinder Has 108-in. Capacity

This new No. 48-96 vertical spindle surface grinder, the largest made by the company, has a 96-in. diameter, fully magnetic chuck, and will swing and grind to the center of work up to 108 in. in diameter. Chuck will hold a maximum work load of 10,000 lb. Work up to 40-in. high can be accommodated under a new 48-in. diameter Cortland type segment wheel.

Regularly supplied with 100 hp spindle motor, the new grinder is also available with motors up to 150 hp.

Blanchard Machine Co, 64 State St, Cambridge 39, Mass

MORE DATA? Circle 61, inside back cover



Easco Electric Discharge Machine Handles Workpieces 3x4 ft Weighing up to 6000 lb

This Die-Matic electrical discharge machine, designed on the building block principal, will machine die blocks measuring 3 x 4 ft and weighing up to 6,000 lb. In roughing operations, in which metal can be removed at 6 cu in. an hr, ratio of metal-to-electrode wear is maintained at from 30:1 to as much as 50:1.

In the cut, above, the door of the dielectric tank has been dropped. Steel steps for access to top of machine do not show.

The machine's versatility allows it to run electrodes as heavy as 500 lb and as small as 0.005-in. dia on the same machine. A compound table can be added to the platen, and such accessories as rotating attachments, centering microscope, tramming device, and precision measuring equipment can be added for individual requirements.

Standard features of the fully automatic machine include: 36 x 48-in. work table; 200 gal work tank which fills in 5 min; portable dielectric supply tank capable of handling 800 gal; 18 x 24-in. T-slotted electrode platen; electro-hydraulic servo with 18 in. vertical travel; 30-in. open gap between bottom of platen and top of work tank. Power rating is 6.5 kw.

Controls can be set for the complete rough cutting, and the machine left for the run, except for replacement of electrodes. The same is true for the precision finish.

Easco Products, Inc, Ann Arbor, Mich

MORE DATA? Circle 62, inside back cover

Solid State System Converts From Paper to Magnetic Tape

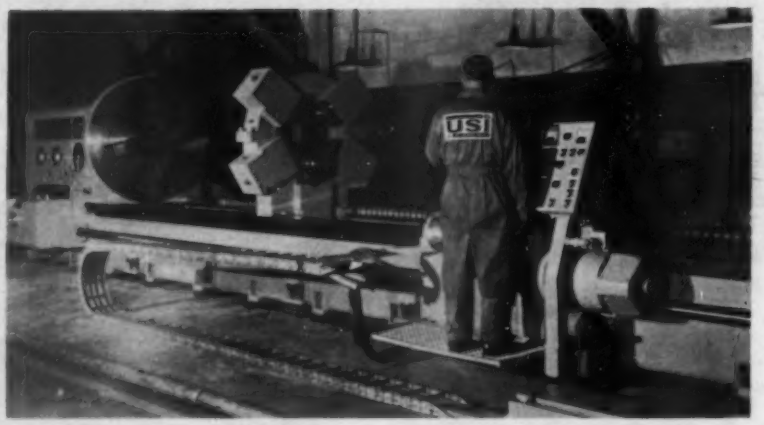
Model 1433 solid state system extracts data from punched paper tape and writes it on magnetic tape. Conversion of data assures that input and output data are completely identical in content. No code change is normally performed; therefore, output record is a bit for bit image of input perforated tape.

A universal code conversion feature is available at extra cost. System will accept paper, foil, or plastic tapes in widths from 5 through 8 channels, and can write data on magnetic tape in formats compatible with IBM 727, 729 Mod 1, and Remington Rand computer inputs.

The system is complete in itself, including a paper tape reader which can read 120 characters a sec, a magnetic tape handler and necessary electronics for control.

Tally Register Corp, 1310 Mercer St, Seattle, Wash

MORE DATA? Circle 63, inside back cover



Clearing-Axelson Heavy Duty Lathe, Made Of Welded Steel, Turns 40-in.-Dia Stock

Said to be one of the world's largest lathes, this 5040 is more than 66 ft in overall length. The lathe, built entirely of welded steel, can turn a part 40 in. in dia and up to 50 ft long.

Because of the 5040's modular design, the headstock and bed are independent members that are unitized in such a way that the entire structure is said to be more rigid than if it were one piece. It is being shipped to US Steel's plant in Homestead, Pa, in two sections, each about 30 ft.

The drive, electrification, quick change gear box, and control console are removable and serviced as a unit.

One of the Blue Chip series, the lathe can be equipped with either a 75 or 100 hp adjustable speed drive, and headstock is equipped with a hp meter and electric speed indicator. Spindle speeds range from 12½ to 200 rpm and face plate drive speed range is 2 to 50 rpm.

Longitudinal and cross feeds are both infinitely adjustable between 0.0136 to 272.0 and 54.0 in., respectively. A gear box for threading has 54 threads between ½ and 15 tpi (1 to 30, optional).

Clearing, Div of US Industries, Inc, Chicago, Ill

MORE DATA? Circle 64, inside back cover

CIRCLE 169 READER SERVICE CARD ►

LINDE COMPANY

UNION CARBIDE

UNIONARC

REDESIGNED...REBUILT...RELIABLE

Development of a LINDE welding process does not stop with its introduction. In the past 18 months, we have invested over 3000 laboratory manhours to further improve the UNIONARC welding process and equipment. New: portable UAM-2 machine, simplified UAW-2 torch, refined consumables. Improved equipment for an improved CO_2 steel welding process, featuring

- **...wear-resistant flux and wire-guide tubes, super-hard "Stellite" torch body**
- **...automatic flux-CO_2 shutoff valve for precise flow of consumables**
- **...stainless-steel hopper funnel for smooth flux feed**
- **...serrated V-groove drive roll (patent pending) for positive wire feed**
- **...miniature machine—300 lbs. lighter, uses 50% less space**
- **...refined flux that increases metal deposition rates**
- **...proven results: dependable operation with minimum maintenance.**

For field-tested application details, see next page

UNIONARC

Portable machine... produces 30-ipm... top-quality welds

One of the nation's largest construction-equipment manufacturers field-tested 15 UNIONARC UAM-2 machines full time—three shifts a day, six days a week—over 2000 hours per week. Maintenance has averaged less than ½ hour per machine per week, a downtime factor of less than 0.5 per cent. This is tested reliability that insures process advantages:

...cost as low as 27¢/lb. of metal deposited
...deposition rates as high as 25 lb./hour
...speed over 30 ipm on ¼ in. carbon-steel fillets
...quality to strictest specifications—ASME, Military, Bureau of Shipping
...full penetration requiring less preparation, fewer passes, less wire.

On a production basis, these advantages mean substantial savings. A western pipe manufacturer saved 25¢/ft. of weld on 28,000 feet of welds. A southwestern fabricator reduced welding time on three on-site storage tanks (9500 ft. of welds) from 1850 manhours to only 700 manhours. A northern manufacturer eliminated expensive reworking of code assemblies, gained 100% weld acceptance with UNIONARC compared to 50% to 90% with covered electrodes. A mid-western manufacturer eliminated beveling, and reduced pass and wire requirements on Schedule 40 pipe by 2:1 and 8:1 ratios respectively.

UNIONARC welding is an ideal process for carbon steel. On a production basis, it is unquestionably faster and more economical than other CO_2 or covered electrode processes. It uses a wide range of readily-available, low-cost wires that meet any application need. It uses one flux, one low-cost CO_2 shielding gas. It has the speed and weld quality of manual submerged-arc welding, with the advantage of weld visibility. It is a sound, well-engineered process designed primarily for repetitive, high-production work on carbon steel. For these applications, the new UNIONARC UAM-2 machine offers outstanding cost advantages with a field-proven low-maintenance factor that produces clear-cut profit for its user. For detailed information or a live demonstration, call your nearest LINDE office.

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LINDE COMPANY

UNION CARBIDE

Division of Union Carbide Corporation
270 Park Avenue, New York 17, N.Y.

Now you can get any soluble coolant you need . . . from one source . . . Sunoco

Sun is literally a supermarket for soluble oils—all the way from a low-cost emulsifying oil to a chemical coolant. Each one can solve a different production problem. For example:

For versatility at moderate cost, use regular S.E.C.O. (Sunoco Emulsifying Cutting Oil).

For heavy-duty work, use S.E.C.O. HD.

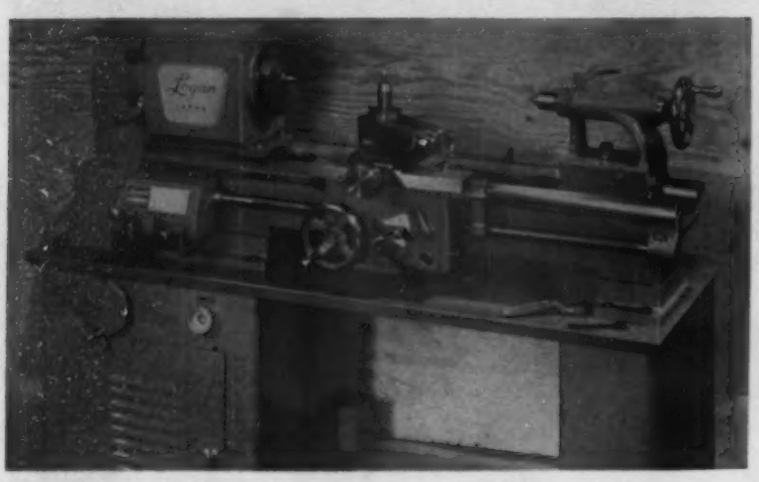
For high detergency, machine or grind with S.E.C.O. 271.

For high-power wetting and lubricity, use Sun's new chemical coolant, Sunicool.

You can profit by checking into the benefits of Sun Soluble Cutting Oils. They've led the field for years . . . they're backed by Sun Oil . . . they're good. And so are Sun's many straight and compounded oils. Ask your Sun man for all the details, or write to SUN OIL COMPANY, Dept. AM-2, Philadelphia 3, Pa. In Canada: Sun Oil Company Limited, Toronto and Montreal.

SUNOCO

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES



Logan Lathe Adjusts Speed Instantly

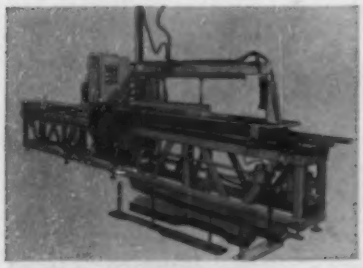
New series of 14-in. swing lathes, which have a variable speed drive of 40 to 1400 rpm, provides for instant speed adjustment without shifting the belt. Other features are 9 in. swing over saddle cross-slides, center distance of 28 in., and two precision ground V-ways and flat ways.

Hardened, ground steel spindle has a 1⅜-in. hole and a draw-in collet capacity of 1 1/16 in. It turns on four sealed and shielded precision ball bearings.

Models are available with 2¼-in., 8-thread spindle and L-00 spindles and with either standard or hardened beds.

Logan Engrg Co, 4901 W Lawrence Ave, Chicago 30, Ill

MORE DATA? Circle 66, inside back cover



Double-Head Contour Router Cuts Both Sides of Work at Once

Machine which follows contours automatically, and is designed to work pneumatically or hydraulically, has a completely adjustable spread that will automatically adjust to any variation in the templet.

The fully automatic unit, designed for the automobile industry in order to solve the problem of machine planing aluminum trim, is adaptable for all such work performed in metalworking, woodworking, and aircraft. In the automobile industry it is reported to have speeded up processing of aluminum trim by many hundred percent.

Crossley Machine Co, 301 Monmouth St, Trenton, NJ

MORE DATA? Circle 67, inside back cover

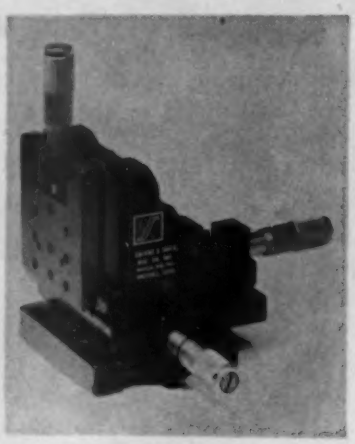
Bearing Block Assembly Certified To 25 Millionth TIR Concentricity

Zero-Spindle bearing block assemblies have been certified to a concentricity of less than 25 millionths TIR (OD and face runout). This feature reduces the total tolerance required in inspecting fixtures and permits greater latitude in checking manufacturing tolerances.

Four sizes of the assemblies are offered from stock. These are used in conjunction with diaphragm chucks and arbors and with collet type arbors. Indicator mount assemblies and baseplates are available for off-the-shelf delivery.

N A Woodworth Co, 1300 East Nine Mile Rd, Detroit 20, Mich

MORE DATA? Circle 68, inside back cover



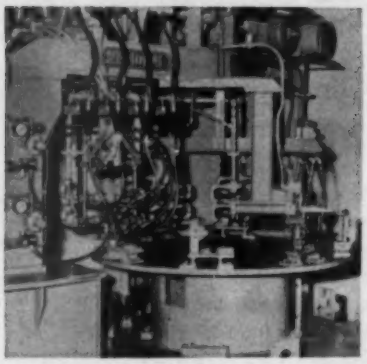
Micro-Positioner Operates In Three Planes

Model 200 provides smooth, accurate, and quick positioning in three planes, X, Y, and Z. Three precise micrometer assemblies insure a steady measured movement up to ½ in. Both vertical and horizontal faceplates contain holes for mounting tooling or other devices or mounting onto other equipment. Glare-proof micrometers have special crowned anvils for accuracy and low friction.

Range is 0.500 in. in both horizontal planes and vertical plane 0.001-in. micrometers are standard; 0.0001-in. and metric micrometers to special order. Weight is 5 lb and price is $200.

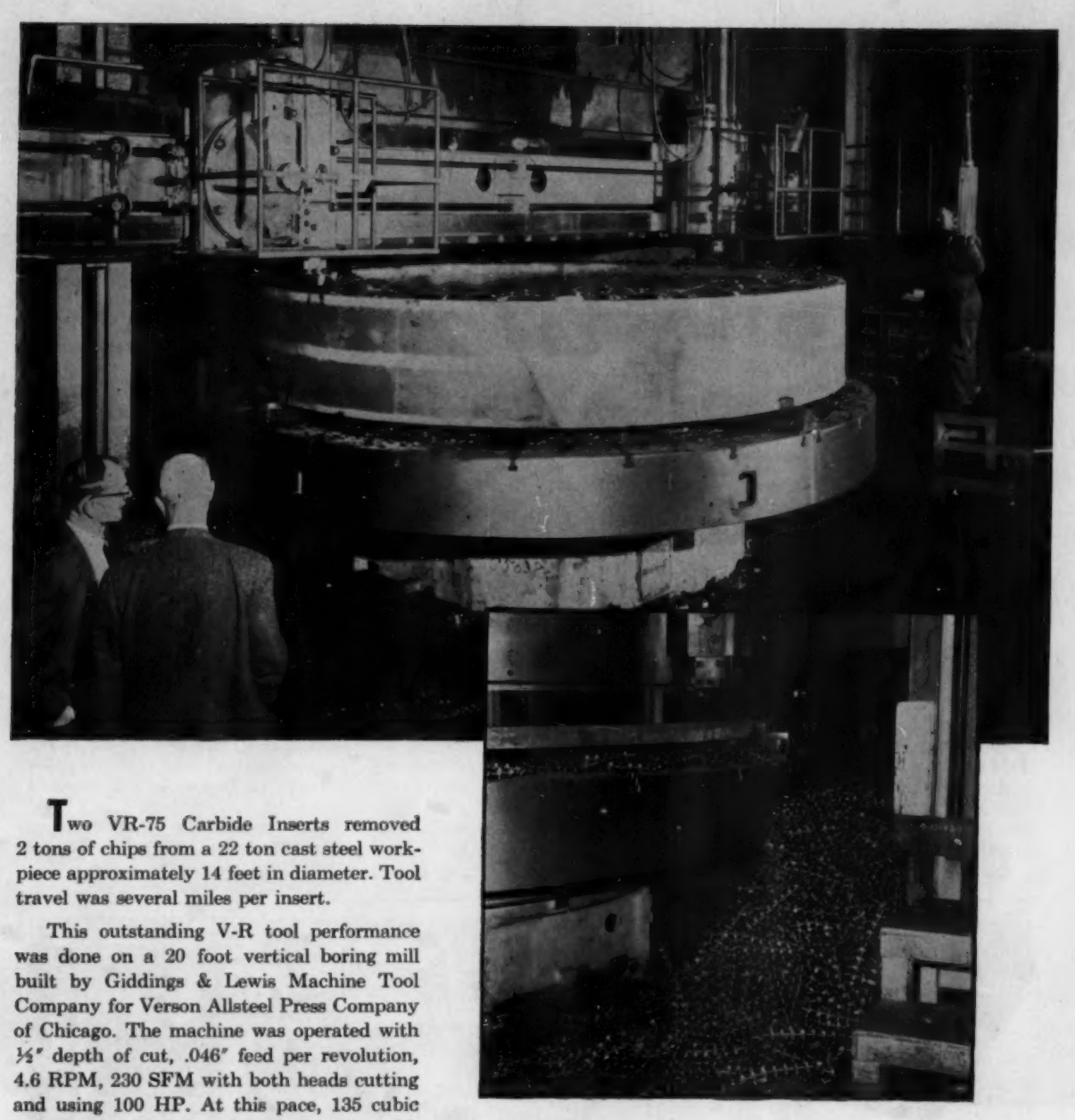
Kulicke & Soffa Mfg Co, 1234 Gallowhill St, Philadelphia 23, Pa

MORE DATA? Circle 69, inside back cover



AUTOMATIC DIAL FEED BRAZER, with eight stations, produces 300 accelerator linkages an hr. Operator loads two levers in self-aligning upper and lower fixtures, slips a rod in position, and then depresses a foot switch to begin automatic sequence—*National Electric Welding Machines Co, 1846 Trumbull St, Bay City, Mich*

MORE DATA? Circle 70, inside back cover



Two VR-75 Carbide Inserts removed 2 tons of chips from a 22 ton cast steel workpiece approximately 14 feet in diameter. Tool travel was several miles per insert.

This outstanding V-R tool performance was done on a 20 foot vertical boring mill built by Giddings & Lewis Machine Tool Company for Verson Allsteel Press Company of Chicago. The machine was operated with ½" depth of cut, .046" feed per revolution, 4.6 RPM, 230 SFM with both heads cutting and using 100 HP. At this pace, 135 cubic inches of metal were removed per minute. A finishing cut followed using 8 RPM, 360 SFM with .023" feed per revolution.

Such successful case histories are not unusual at Vascoloy-Ramet. V-R's exceptional carbide quality will give you the same outstanding service. Call your V-R man in today, or write for a fully illustrated catalog.

4,000 pounds of chips removed with only two VR-75 Carbide Inserts

CREATING THE METALS THAT SHAPE THE FUTURE

V-R VASCOLOY-RAMET

804 MARKET STREET • WAUKEGAN, ILLINOIS

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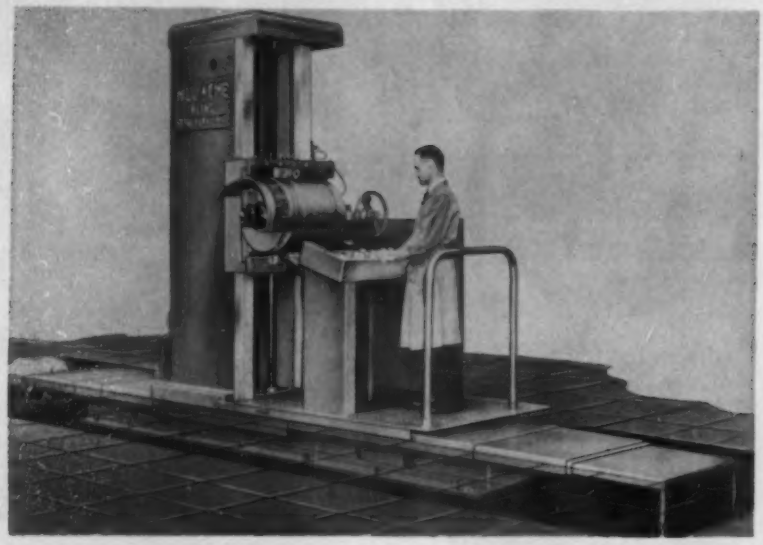


Redesigned Kling Structural Mill Now Being Manufactured, Sold by Hill Acme

The Kling mill, for end milling of structural shapes, has been completely redesigned and has the following new features: ball screw leadscrews, non-metallic precision ground ways, hydraulic binders, centralized automatic pressure lubrication, and welded steel construction.

The machine, which now weighs 18,250 lb, has a horizontal travel of 120 in. and vertical travel of 60. A 40 hp direct drive spindle motor gives 10-in. infeed. Either 4½ or 5-in. dia cutters, with carbide inserts, will feed 30 ipm with ½ hp motor or 60 ipm with 3 hp motor.

Kling Div, The Hill Acme Co, 1201 W 65th St, Cleveland 2, Ohio

MORE DATA? Circle 71, inside back cover

Metal Stamping Dies Hold Contour Tolerances as Close as 0.005

These dies are reported to hold their accuracy and burr-free qualities for short run production of up to 50,000 parts. The average thickness of metal stamped from them is ⅛ in. and the metals most commonly used include copper and copper alloys, lead and its alloys, nickel and its alloys, carbon and stainless steels, and aluminum. The dies are made to fit standard die sets and they employ the use of steel cutting rules and punches mounted in Hy-du-lignum bases. Average savings to die users are reported to be nearly 70%.

Acme Steel Rule Die Corp, 212 Baldwin St, Waterbury 20, Conn

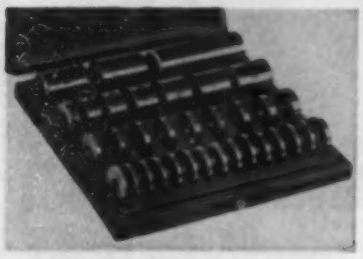
MORE DATA? Circle 73, inside back cover

HSS Bandsaw Blades Improved

Comparative tests on High-speed heavy-duty sawing machines have established that Barnesupreme HSS blades show unusual cutting qualities and longer service life. New techniques in heat treating reportedly produce tooth tips highly resistant to wear, and flex life is measurably increased. Blades are welded to exact specifications and packaged individually for protection and handling ease.

W O Barnes Co, 1297 Terminal Ave, Detroit 14, Mich

MORE DATA? Circle 74, inside back cover



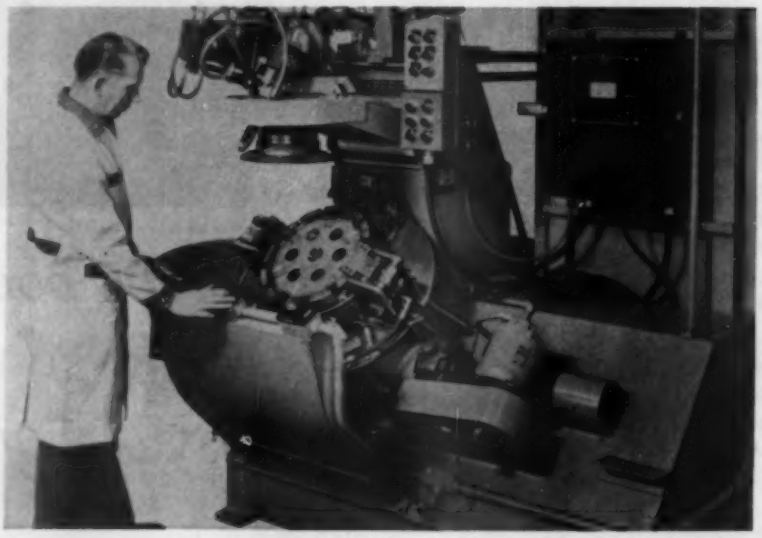
Herson Space Blocks Speed Setup On Lathes, Millers, Drillpresses

These gage blocks, made of hardened steel and lapped to a ±0.0001 tolerance, are sold in sets of 34, priced at $57.50 per set. Each block is ¾ in. in diameter and the set offers a complete range of sizes that can provide 4854 combinations.

Sizes range 0.050 to 0.100 in. in increments of 0.010 in.; 0.100 to 0.110 in. by 0.001-in. increments; 0.110 to 0.200 in. by increments of 0.010 in.; 0.200 to 1.00 in. by 0.100-in.

Carlson Tooling, 31 Santa Clara St, Arcadia, Calif

MORE DATA? Circle 72, inside back cover



SINGLE-STATION ROTARY WELDING MACHINE automatically welds ring gear to hub in making flywheel assemblies. Machine shown welds a gear with a 13¼-in. ID to a hub with 12 equally spaced 1⅛-in. CO_2 shielded-arc weld segments at rate of 171 assemblies an hr—*Expert Welding Machine Co, 17144 Mt Elliott Ave, Detroit 12, Mich*

MORE DATA? Circle 75, inside back cover

Helixform*—a new method for bevel gear production!

The new No. 112 Hypoid Helixform Gear Finisher assures improved quality and increased production on spiral bevel and hypoid non-generated ring gears up to 10½" in diameter, and 2½ DP such as employed in passenger car axles.

The Helixform Cutting Method used on this machine offers these advantages:

Conjugate tooth surfaces, minimized gear development, complete control of tooth bearing, and greater adjustability in final assembly.

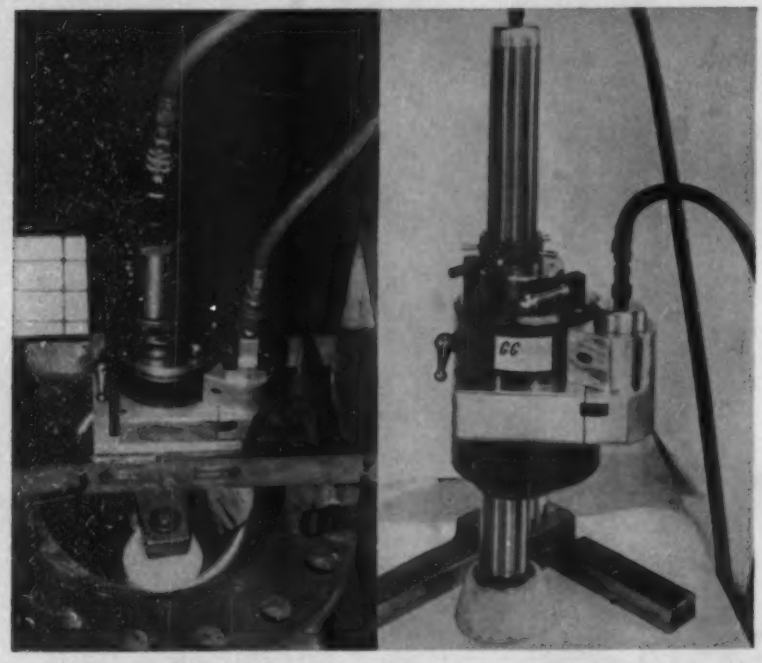
We will be glad to send a bulletin giving further details on request. Ask for literature on the No. 112 Hypoid Helixform Gear Finisher and the companion No. 112 Hypoid Gear Rougher. Write for it today.

*Trade-Mark

GLEASON WORKS

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

CIRCLE 240 READER SERVICE CARD



Precision Grinder Can Be Carried to Work

This lightweight, portable grinding machine (top, right) eliminates many problems normally associated with precision maintenance work. At left it is grinding parallel flanges on valve and mating steam end of a multi-ton control valve. The joints had to be steam-tight without use of gaskets, and capable of holding 900 lb pressure at 700 F.

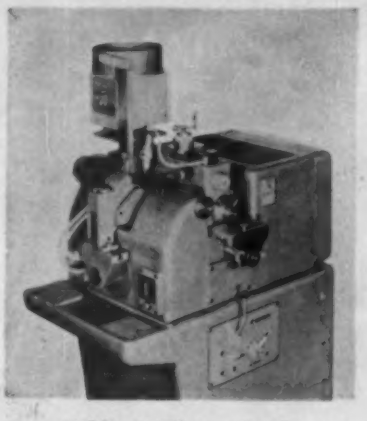
Developers of the machine, called a "GIG," claim that in preliminary usage it has handled a variety of grinding, machining, and boring jobs in difficult spots which could not be reached with ordinary equipment.

The GIG, which weighs only 37 lb, has its quill mounted on matched Timken bearings of machine tool quality. It is driven by a variable speed, high torque air motor. Because a smaller air motor, operating on adjustable eccentrics, rotates the grinder spindle assembly in circles offset up to 1½-in. in diameter with reference to the centerline, a lathe compound for collector ring and valve grinding is not necessary.

The machine, which was introduced at the Plant Maintenance & Engineering Show in Chicago, can be taken to a repair job by one man. The work can be performed in place and, in most instances, dismantling of equipment is not necessary.

Gilmore Industrial Grinders, Inc, Houston, Tex

MORE DATA? Circle 79, inside back cover



Gear Hobber's Plunge Feed Increases Production up to 75%

Mikron No. 21 gear hobbing machine can be used as a hand-loaded, semi-automatic, or fully automatic production machine. Only a simple tooling change is necessary to shift from one type of operation to another. The automatic loading mechanism is contained in one small casting and can be removed or applied to the machine in a few minutes.

Except for hob and spindle speeds, the model is completely hydraulic. The hydraulic unit controls infinitely variable feeds, the automatic hob cycle, and the automatic deburring tool. A plunge feed is part of the hob cycle and is also infinitely variable. This eliminates hob approach and increases production up to 75% over conventional gear hobbers. Cutter speeds are from 400 to 4800 rpm; feeds are 0 to 0.006 in. per second.

Dist by Russell, Holbrook & Henderson Inc, 292 Madison Ave, New York, NY

MORE DATA? Circle 77, inside back cover

5-hp Transmission Provides Instantaneous Reversing

Electromission, developed primarily to provide high-speed positioning, reversing, and sequencing of loads for industrial servo systems and automated systems using card or tape control, consists of an input and an output shaft connected through either a gear drive or a chain drive depending upon the status of two opposing electromagnetic clutches. Engaging one clutch provides chain drive for same-direction rotation of the output shaft compared to the input shaft. Engaging the other clutch produces gear drive for opposite-direction rotation of the output shaft.

Airborne Accessories Corp, Industrial Div, 1414 Chestnut Ave, Hillside 5, NJ

MORE DATA? Circle 78, inside back cover

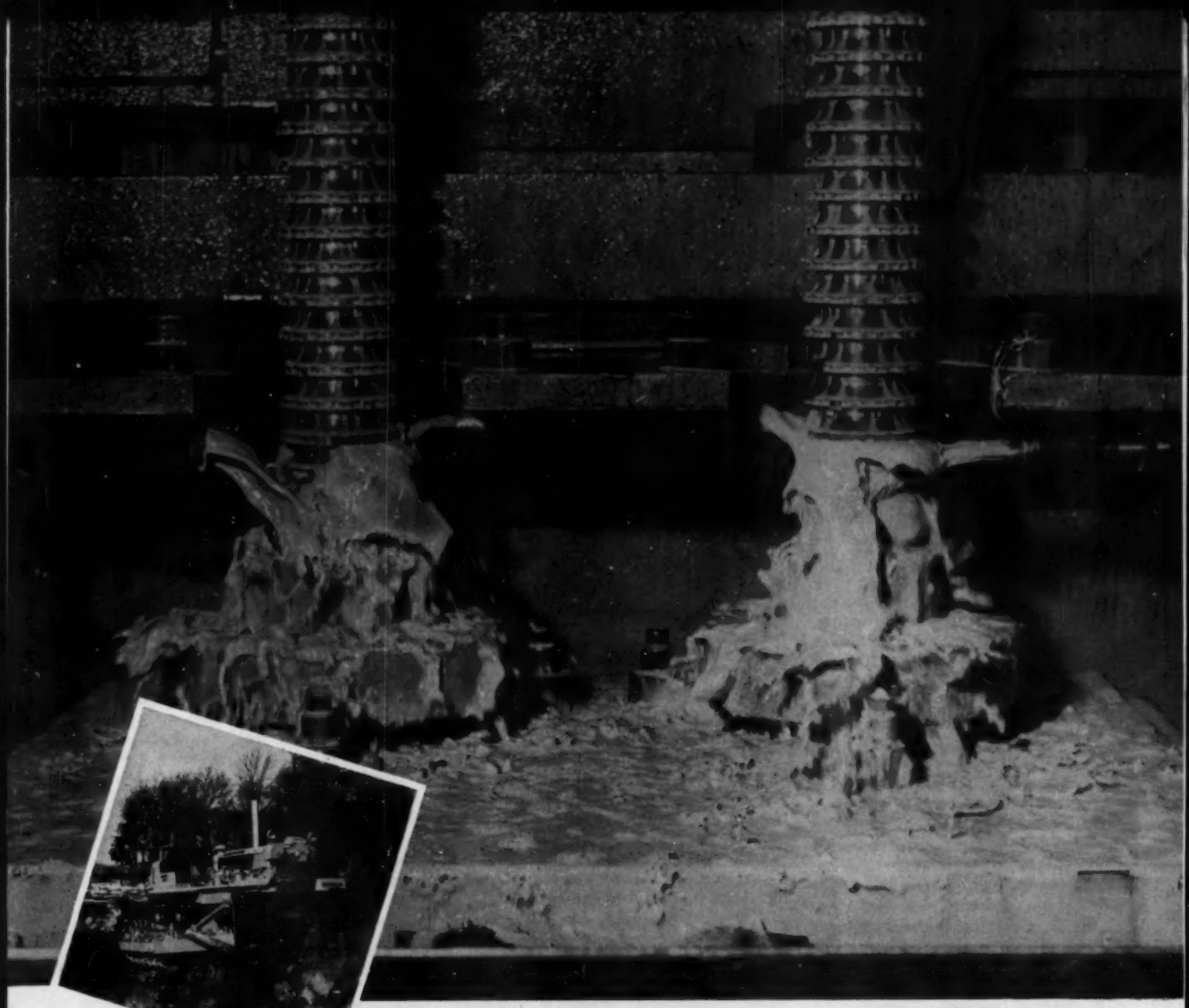
3-in. Vibratory Feeder Handles Minute Parts

Model 3 has been engineered for automatically orienting and feeding minute parts for machining or assembly operations. Comprised of a base and a 3-in. molded bowl, it is furnished with rheostat variation control on and off switch and a 5-ft power cord, all mounted as a single unit. The bowl will handle disk shaped parts from the smallest diameter to ⅛ in. and cylindrical shapes with length variations up to 5/16 in.

Overall dimensions, including controls and base plate, are 3½ x 5⅛ in.

Automation Devices Inc, VFC Div, Erie, Pa

MORE DATA? Circle 79, inside back cover



Caterpillar D-7 Series D Tractor with 7A Cable-controlled dozer

Broaching a spline in gear blanks of 4100 Series grade steel with a Colonial Broach Machine using Kerns Soluble Cutting Fluid at Caterpillar Tractor Co., Peoria, Ill.

IMPROVE YOUR BROACHING OPERATIONS...

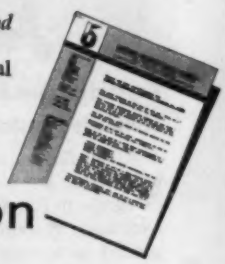
like Caterpillar Tractor Co. did by changing to a *specialized* water soluble cutting fluid. This tailored lubricant by Kerns United keeps parts exceptionally cool, cuts down tool expansion providing greater consistency through the day with little or no welding of chips to cutting edge.

Kerns lubricant proved cleaner around machine area with much less dragout of material. For instance . . . prior to the Kerns product, parts were heavily coated, hard to handle and required a pre-assembly wash operation. Kerns eliminated wash operations and parts now can be easily handled by hand.

Consult Kerns United now . . . work with industrial lubricants that are tailored to meet your requirements at a savings . . . investigate Kerns Memo Billing Trial Basis that provides for no formal billing until proven in production.

Manufacturers of Cutting, Grinding, Drawing, Forging, Phosphatizing, Cleaning, Wire Drawing and Spray Booth Compounds; Cling Oils, Rolling Oils, Rust Preventives and Specialized Greases.

Write now for further information on any one of these products and/or Kerns Memo Billing Trial Basis . . . no obligation of course.



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KERNS UNITED Corporation

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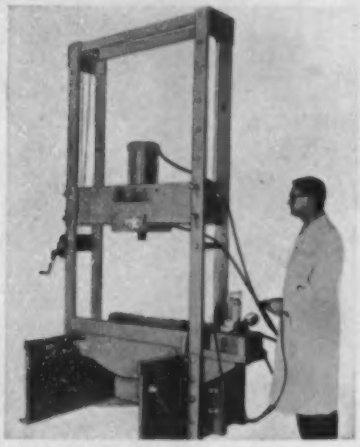
Subsidiary: KERNS PACIFIC Corporation, *630 N. Batavia St., Orange, California*

Offices in Principal Cities throughout the U.S.A.

CIRCLE 241 READER SERVICE CARD



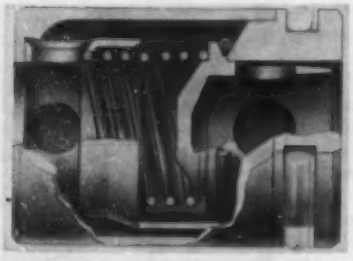
Hydraulic Shop Press Has Two-Stage Pumping Unit

Hydraulic presses, 50 and 100-ton capacity, incorporate double-acting, heavy-duty cylinders and high-speed, two-stage pumping units. OTC roll-bed feature permits safe, easy loading and unloading of hard-to-handle work outside of press frame. Vertically adjustable crosshead and horizontally adjustable cylinder workhead also add flexibility and speed.

High-pressure hydraulic cylinders for operating pressures up to 10,000 psi are specially constructed for heavy duty, continuous service; stroke length can be specified. Compact Vanguard high-speed two-stage hydraulic pumping unit speeds ram approach and return, delivers from 600 cu in. per min (2.6 gpm) at 0-100 psi up to 50 cu in per min at 10,000 psi. Vanguard pumping unit (45 lb) is detachable for independent use in powering other hydraulic equipment.

Owatonna Tool Co, 512 Cedar St, Owatonna, Minn

MORE DATA? Circle 80, inside back cover



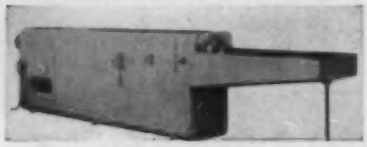
Cartridge Check Valve Features Simplified Installation

The 200 Series cartridge-type check valve can be easily installed as an integral part of any pneumatic or hydraulic system. It is designed to be placed in a single bored hole, eliminating bulky complicated piping arrangements and reportedly saving over 75% of the design and installation costs formerly required.

The unit, available in steel or aluminum in sizes from ⅛ to ¾ in., operates at pressures up to 5000 psi. The cage device positively restrains the O-ring, preventing possible washout. Additional advantages include air-tight sealing and chatter-free operation.

Circle Seal Products Co, 2181 E Foothill Blvd, Pasadena, Calif

MORE DATA? Circle 81, inside back cover



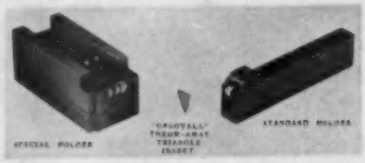
Horizontal Broach Has Capacity Of 15 tons, 60-in. Cutting Stroke

Model H 1560, with up to 60 in. of cutting stroke, has fully variable cutting speeds up to 22 fpm and 60 fpm-return stroke, permitting extremely high speed production. It is designed for rapid setup of either short or long runs requiring high accuracy, and is adaptable for either surface or internal broaching.

Additional features include fully adjustable pull head mounted on hardened and ground slide ways; 10-in. faceplate opening; chip pan coolant receiver; and separately motorized coolant system. Overall size is 144 in. long, 33½ in. wide, 46 in. high. Power equipment included as standard: 10-hp main hydraulic motor; ½-hp coolant pump motor; all switches and electrical controls; hydraulic oil reservoir and coolant reservoir located in base of machine.

Pioneer Broach Co, 6434 Telegraph Rd, Los Angeles 22, Calif

MORE DATA? Circle 82, inside back cover



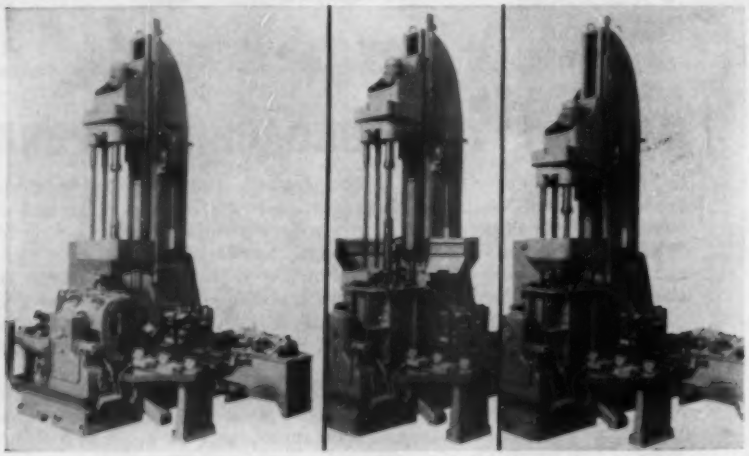
New Grooving Technique Uses Triangle Throw-Away Inserts

The holder, known as Groovall, designed for these tools, makes them self-locating and self-locking in the pocket. Clamps are used as a safety factor, according to manufacturer, but the entire pressure of the cut is absorbed by the geometry of the tool. Cutting pressures become compression forces that seat the insert.

Tool life is said to be high, as traverse strains are eliminated. Use of the triangles allows the top rake necessary when machining aluminum. Side clearance can easily be applied; back clearance can be incorporated to avoid bell-mouth grooves.

US Tool & Cutter Co, 28975 Orchard Lake Rd, Franklin, Mich

MORE DATA? Circle 83, inside back cover



THREE-SPINDLE LINE-BORING MACHINE, with 48-in. stroke, finish bores camshaft bearing holes, balance hole, and crankshaft-bearing seats in V-6 and V-12 engine blocks. A hydraulic feed locates engine block in fixture which upends (see center view) to align work holes with boring tools. Before starting rotation, boring bars approach work in rapid traverse until pilot diameter enters bore—*The Foote-Burt Co, Cleveland 8, Ohio*

MORE DATA? Circle 84, inside back cover

Improved reliability • Greater capacity • No increase in price

NEW DIRECTIONAL VALVE DESIGNS WITH VICKERS Q-E-L* SOLENOIDS

- New Q-E-L* solenoids assure quiet, cool operation plus shock-free performance through superior cushioning.
- Four to five times more cycle life than previously obtainable with ordinary air-cooled solenoids.
- Capacity increased from 50 to 500% on new designs.
- All models suitable for pressures to 3000 psi.
- Complete range of sizes available for maximum flows to 440 gpm.

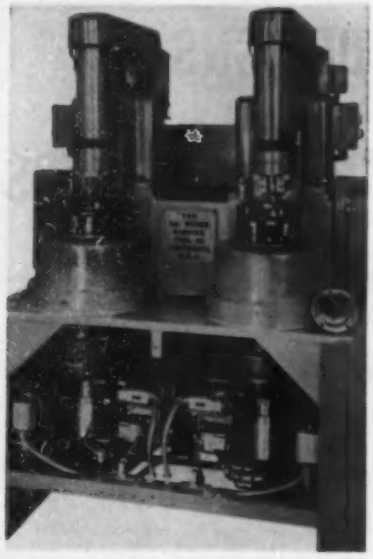
MODEL DG4S4 is rated at 8 gpm (with nominal pressure drop) with a maximum allowable capacity of 12 gpm without malfunction. Maximum recommended operating pressure is 3000 psi. Standard subplates are available with ⅜ in. or ½ in. pipe thread ports. SAE straight thread port connections can also be provided.

MODEL DG5S4 solenoid-controlled, pilot-operated valve is rated at 30 gpm (with nominal pressure drop) with a maximum capacity of 80 gpm without malfunction, depending on circuit conditions and valve type. Standard subplates are available with ¾-in. and 1 in. pipe thread connections. SAE straight thread port connections can also be provided. Write for Catalog 5001-C.

8596

* Q-E-L designates Quiet Extended Life solenoid—a *Vickers exclusive.*

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1410 **Detroit 32, Michigan**



DUPLEX VERTICAL PRECISION HALF-MILL mills circular grooves to pre-planned tapered depths in production of pump units for automatic transmissions. The compact machine is now operating in plant of a leading auto manufacturer—*US Burke Machine Tool Co — Brotherton Rd at Pa RR, Cincinnati 27, Ohio*

MORE DATA? Circle 85, inside back cover

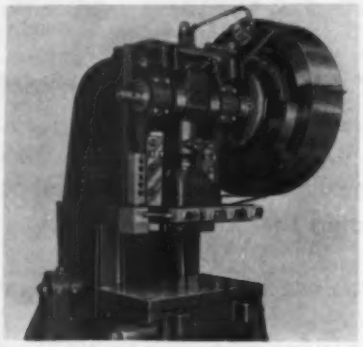
Lorco Adds Small Bench Model To Vibratory Finishing Line

Model 610 has a ¼-cu-ft capacity with a bowl measuring 6 in. wide, 10 in. long, and 8 in. deep. Overall dimensions of the machine are 12 in. wide, 34 in. long, and 28 in. high.

Designed for finishing of small and delicate parts, the unit has a load capacity of approximately 35 lb of parts and media. The 30-lb removable bowl clamps on to the bed of the vibrator and rests on four coil springs. Model is powered by a ¾-hp motor which drives a variable amplitude shaft by means of a variable pitch pulley. Speed is variable from 700 to 3500 vpm. Variable amplitude is accomplished by changing the position of counterweights on the shaft.

Lord Chemical Corp, 2068 S Queen St, York, Pa

MORE DATA? Circle 86, inside back cover



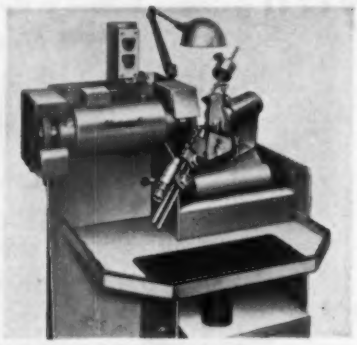
Design of 70-ton Press-Rite Increases Die Life up to 50%

New 70-ton Press-Rite power press features high tensile semi-steel frame with tierods built in for longer die life. Design provides maximum ram rigidity with less deflection. Binding and misalignment of dies during heavy blanking and drawing operations are reduced to a minimum. This increases die life up to 50% over conventional open-back, inclinable presses, according to manufacturer.

In addition to fast operation, the unit incorporates a ram with extra-large face area for handling heavy-duty jobs as well as small ones. Ram also has a special steel removable bushing in the die shank hole in the slide. Full lubrication during fast operation is insured on the front and rear ways.

Havir Mfg Co, 444 Cleveland Ave, St Paul, Minn

MORE DATA? Circle 87, inside back cover



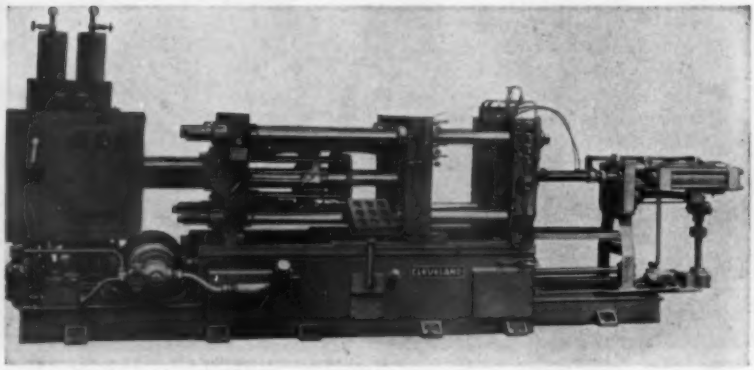
Multi-Point Drill Grinder Speeds Setup Changes

Model DG-1, available for either wet or dry grinding, and incorporating the principle of conical grinding, grinds both general and special purpose points. The wide variety of points it can produce is obtained with quick, simple adjustments of the ⅛ to 1-in. drill holder.

The holder can be swiveled in seconds to any point angle between 60 and 180° and set for minimum, maximum, or normal relief angles. A quickly adjustable stop limits the holder swing for three and four lip drills.

Hammond Machinery Builders Inc, 1618 Douglas Ave, Kalamazoo, Mich

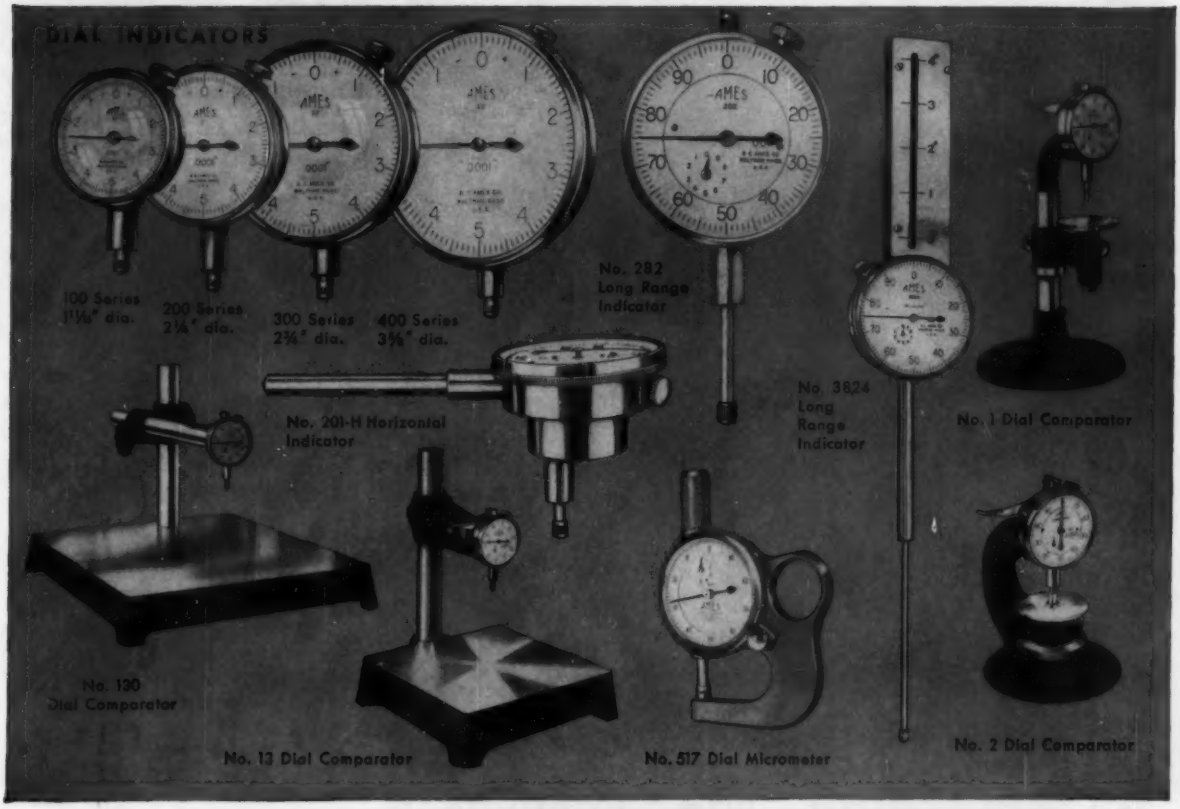
MORE DATA? Circle 88, inside back cover



MODEL 400 DIE CASTING MACHINE, which has a strain gage tested locking pressure of 400 tons or better, has 40½ x 40-in. (vert and hor) size die plates, with 20 x 24-in. space between tie bars. It will take dies having 32-in. max and 12-in. min thickness, with an adjustable die opening from 6 to 12 in.—*Cleveland Automatic Machine Co, 4932 Beech St, Cincinnati 12, Ohio*

MORE DATA? Circle 89, inside back cover

AMES *Masters of Measurement*


DIAL INDICATORS
100 Series 1 1/16" dia.
200 Series 2 1/4" dia.
300 Series 2 3/4" dia.
400 Series 3 5/8" dia.
No. 282 Long Range Indicator
No. 201-H Horizontal Indicator
No. 3824 Long Range Indicator
No. 1 Dial Comparator
No. 130 Dial Comparator
No. 13 Dial Comparator
No. 517 Dial Micrometer
No. 2 Dial Comparator

DIAL INDICATORS AND GAUGES

Use Them for Checking: taper, height, depth, flatness, roundness, straightness, thickness, diameter, length and size.

Features Include: easy-to-read dials, unbreakable crystals, forged cases, backs and wheel support, contour-lapped pinion teeth.

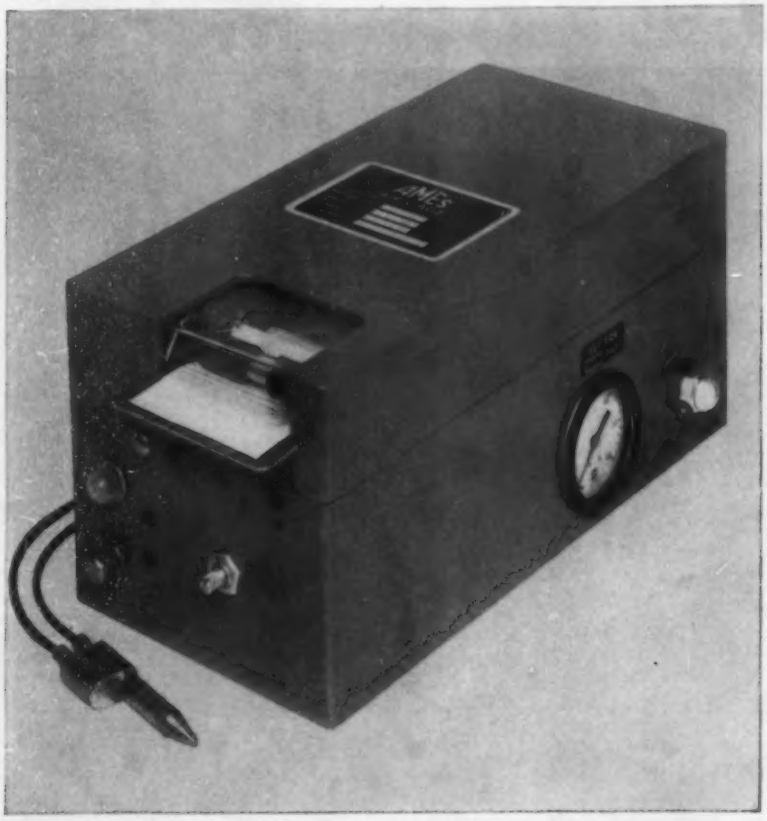
Attachments: rubber and metal dust guards, long stem indicators, tolerance hands, lift levers, special backs, contact points, etc.

For literally hundreds of measuring, indicating and comparing operations, you'll find Ames standard and customized gauges and indicators unerringly accurate and amazingly durable . . . *You're asking for the best when you specify Ames!*
B. C. AMES CO., Waltham 54, Mass. Representatives in Principal Cities—
In Canada, H. C. Burton Co., 166 Rebecca Street, Hamilton, Canada.

B. C. AMES CO.

MANUFACTURERS OF MICROMETER DIAL INDICATORS, DIAL GAUGES, ACCU-FLOW AIR GAGES, PORTABLE TRANSISTORIZED COMPARATORS

AMES *Masters of Measurement*



ACCU-FLOW Air Gaging Equipment

The new line of ACCU-FLOW air gages developed by B.C. Ames includes several patented components, including nozzles and pressure indicators, which give these gages unusual range and exceptional linearity.

Special Models are Available for Checking: outside and inside diameters, center distances, flatness, roundness, hole depths and continuous non-contact measuring or comparing of paper, metals, plastic films, etc.

Ames ACCU-FLOW Air Gages are providing the answer to many measuring problems that were once considered impossible to solve. For complete information on the entire line of Ames air gaging equipment, write for new ACCU-FLOW folder. *You're asking for the best when you specify Ames!*

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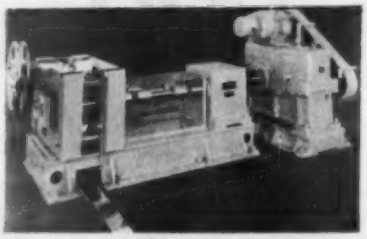
B.C. AMES CO.

MANUFACTURERS OF MICROMETER DIAL INDICATORS, DIAL GAUGES, ACCU-FLOW AIR GAGES, PORTABLE TRANSISTORIZED COMPARATORS



Horizontal Compacting Mill Turns Out Nickel Strip

The Naeser-Zirm powder rolling method of thin-gage strip production has been brought within reach of the smaller metal fabricator and pilot plant by the development of this compacting mill with edge control. While the technique is particularly well suited to the production of nickel strip for the electronics field, it is also being employed successfully in the manufacture of nuclear fuels, stainless steel filters, and copper radiator stock.

Model 1000 employs 10-in.-dia by 8-in.-wide rolls made of alloy tool steel and hardened to Rh 64 C. The two rolls are mounted side by side rather than one above the other as in conventional mills. In operation, fine metal powder is continuously fed into the mill through a hopper equipped with flow controls. Green strip leaves the mill on an exit chute at speeds varying from 12.5 to 50 fpm and is passed continuously into a protective atmosphere sintering furnace.

Loma Machine Mfg Co, 114 E 32nd St, New York 15, NY

MORE DATA? Circle 90, inside back cover

Sunbeam Wide Range Furnace Operates at 300 to 2400 F

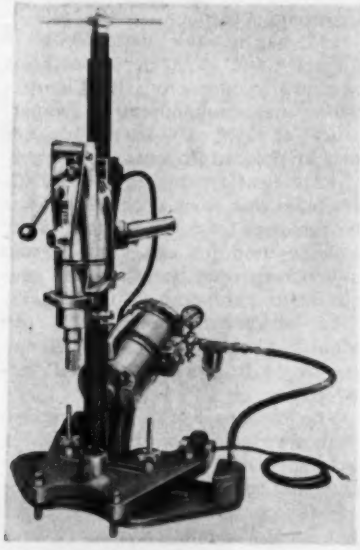
This furnace can be used for practically every heat treating process including annealing, pack carburizing, hardening, normalizing, preheat-

ing, stress relieving, and tempering. Both ferrous and non-ferrous alloys may be heat treated under accurate temperature control. Burners have a 95% turn down ratio for close temperature control.

They are available for gas fired heating in three standard sizes with work areas ranging from 4 in. high by 8 in. wide by 12 in. deep to 9 x 15 x 24 in.

Sunbeam Equipment Corp, 180 Mercer St, Meadville, Pa

MORE DATA? Circle 91, inside back cover



Vacuum Pad Anchors Portable Drilling Machines

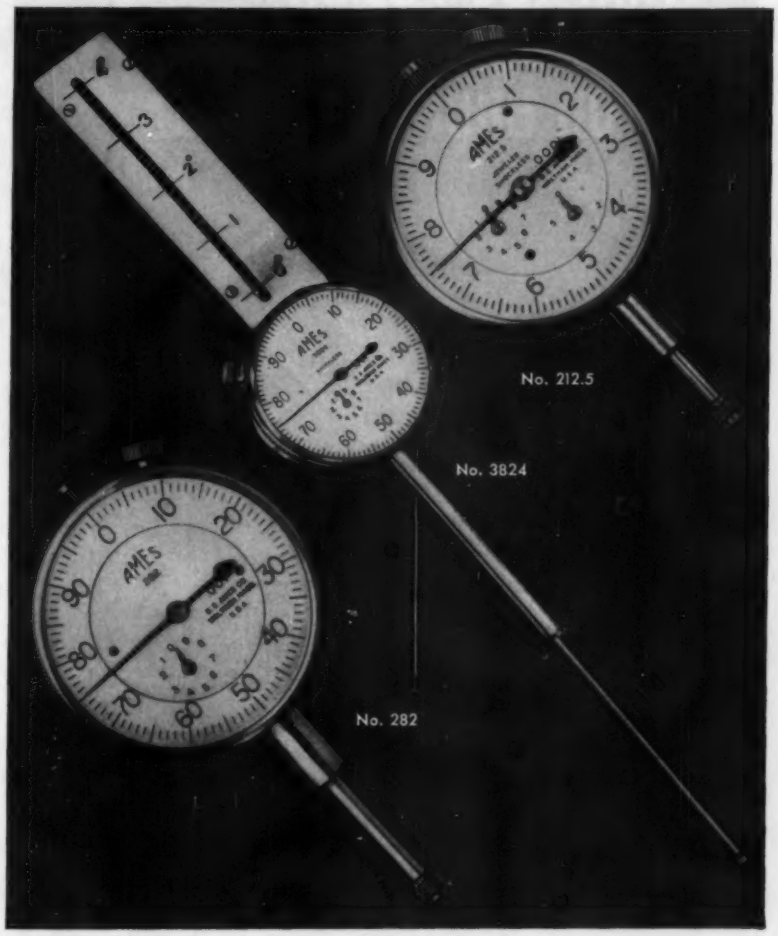
Truco Tru-Vac is an accessory that can be used with Truco portable diamond drilling machines as well as with others. The device permits the drilling machine to be set up with the base parallel to the work or, if desired, horizontal, while drilling on an incline—on a ramp, for instance, where vertical holes are needed.

The unit consists of a flat aluminum pad resting in a molded rubber gasket which seals it to a floor or wall surface when vacuum is applied. Vacuum is developed by means of an electric motor and pump unit which plugs into any standard circuit. A pressure gage and dust collector cup are included. When vacuum is released, the machine with the pad attached can be wheeled to the next location and set up in moments. The standard unit develops approximately 1000 actual pounds of vacuum.

Wheel Trueing Tool Co, Masonry Drilling Div, Detroit, Mich

MORE DATA? Circle 92, inside back cover

AMES *Masters of Measurement*



Long Range Dial Indicators

Use Them for Checking: long slide travel, large cams, deep recesses or other dimensions requiring indicator spindle travel up to 12".

Features Include: large diameter dials, widely spaced dial graduations, movable dials, replaceable contacts and count hands.

For literally hundreds of measuring, indicating and comparing operations, you'll find Ames standard and customized gauges and indicators unerringly accurate and amazingly durable . . . *You're asking for the best when you specify Ames!*

B. C. AMES CO. Waltham 54, Mass. Representatives in Principal Cities—In Canada, H. C. Burton Co., 166 Rebecca Street, Hamilton, Canada.

B. C. AMES CO.

MANUFACTURERS OF MICROMETER DIAL INDICATORS, DIAL GAUGES, ACCU-FLOW AIR GAGES, PORTABLE TRANSISTORIZED COMPARATORS

NEW OSBORN POLISHING/BUFFING LATHES . . . these compact, variable speed lathes are Osborn-engineered to handle your work economically at highest efficiency. Available with balanced single or double spindles, fixed or variable speed ranges from 600 to 3600 rpm. Variable speed lathes have 3-to-1 speed range. Choice of 3, 5 or 7½ hp motors. Other features include: motor-mounted magnetic disc brakes for instantaneous spindle stopping. Roto-Cone drive for instant, vibration-free power transmission and speed changes.

FREE BULLETIN 620 includes complete specifications, operating and construction details plus application data. For your copy, write or call *The Osborn Manufacturing Company, Dept. C-108, Cleveland 14, Ohio. Phone ENdicott 1-1900.*

Metal Finishing Machines
. . . and Finishing Methods
Industrial Brushes
Foundry Production Machinery

OSBORN

CIRCLE 246 READER SERVICE CARD

NEW SHOP EQUIPMENT

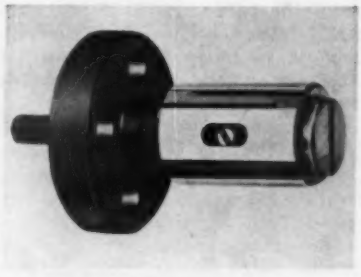
Vacuum Tempering Furnace Operates at up to 1500 F

Vacuum purge controlled atmosphere tempering furnace, series VVD-10x14, has a work space 10 in. in diameter and 14 in. deep; operating pressure to 50 microns Hg; input of 9 kw; maximum operating temperature of 1500 F. It is designed primarily to bright temper work previously heat treated in the VVFC-10x14 so that work does not have to be removed from the basket. It can also be used for annealing ferrous and non-ferrous materials and precipitation hardening of 17-7HP, 17-4PH, beryllium copper, A-286. An alloy work basket 10 in. in diameter by 14 in. deep is charged vertically.

The furnace works with any gas that is reducing, oxidizing, or inert. Internal water cooling coils and directional baffles permit rapid cooling of the circulating gas. The unit can be safely operated under partial pressures or full pressure with such gases as hydrogen, endothermic, cracked ammonia, or rich endothermic.

Ipsen Industries Inc, PO Box 500, Rockford, Ill

MORE DATA? Circle 93, inside back cover



EXPANDING MANDREL has a bushing with leaf spring action for greater flexibility. Construction permits the bushing to compensate for tapered holes, adjust to variations in the hole sizes, and provide for equal chucking pressure at all points. Capacities range from 7/16 to 11 in.—*Balas Collet Mfg Co, Cleveland 14, Ohio*

MORE DATA? Circle 94, inside back cover

the **Monarch** 10" Model EE Lathe is made for sensitive, **super-accurate** turning of small **precision** parts

...and will do this consistently for the life of the lathe!

For super-precision and sensitivity in the toolroom, the Monarch 10" Model EE Precision Toolmaker's Lathe has long been the top choice of toolmakers everywhere. The features responsible for this also make the machine the ideal choice for precision manufacturing operations on such parts as small jet, missile, instrument, electronic and camera components.

General statements about the precision of a machine tool are easy to make. There is an irrefutable proof—the final inspection record. Following are some of the more critical standards as they apply to the 10" Model EE.

	Normal Standards	Monarch Standards
BED		
Level—longitudinal	.0005"	.0005"
Level—transverse	.0005"	.0001"
HEADSTOCK SPINDLE		
Face runout	.0003"	.0001"
Taper runout	.0003"	.0001"
Cam action	.0003"	.0001"
Taper hole runout	.0003"	.0001"
CROSS SLIDE ALIGNMENT		
Concave	.0005"	.0004"
HEADSTOCK ALIGNMENT		
Back of center at end of bar	.0003"	.0003"
High at end of bar	.0005"	.0002"
TAILSTOCK AND HEADSTOCK CENTERS ALIGNMENT		
High at tailstock	.002"	.0005"
LEADSCREW ALIGNMENT		
Vertical	.004"	.0015"
Horizontal	.004"	.0015"
LEADSCREW		
Cam action	.0003"	.0002"
Lead per foot	.001"	.001"
Lead per 4" section	.0004"	.0004"

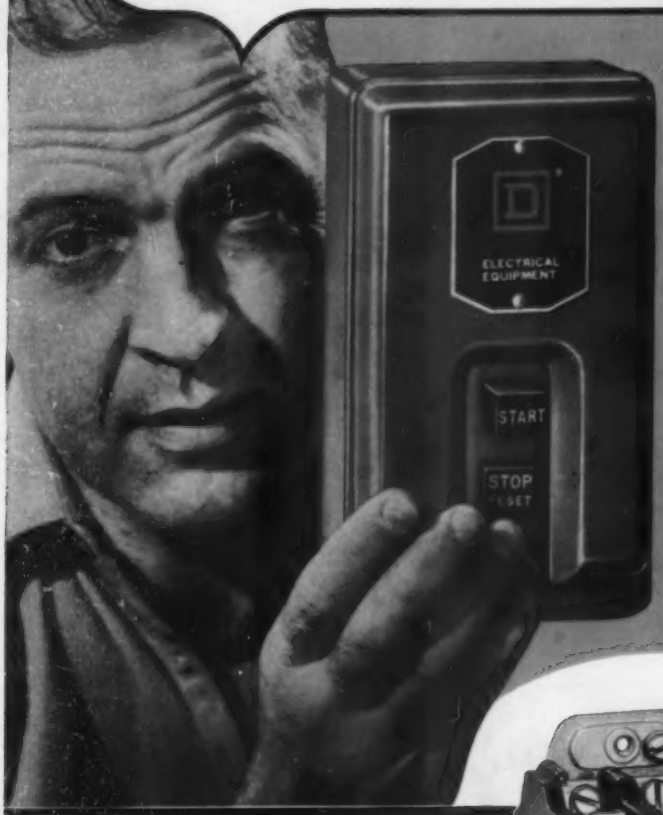
Your search for the means to super-precision turn small parts is at an end. This is attested to by the thousands (that's right, thousands) of 10" Model EE's being used for such work. Ask for our sparkling new booklet No. 307. It tells all. THE MONARCH MACHINE TOOL COMPANY, SIDNEY, OHIO.

MAJOR 10" MODEL EE FEATURES. Drive to spindle through one set of multiple "V" belts at all speeds • Infinitely variable speed ratio of 100 to 1 through direct drive • Very low speeds secured through speed reduction elements of drive which extend ratio to 500 to 1 • Available with exclusive combination of electric leadscrew reverse and variable reverse speed control • Drive from spindle to gear box through endless belt • Drive motor power secured through advanced design of electronic conversion unit • Carriage held in secure alignment by ball bearing gibs • Bed and base made of special alloy cast iron • All four bed ways flame hardened and precision ground • Anti-friction bearings used throughout • Automatic lubrication • Every critical part made of heat-treated steel, accurately finished.

Monarch TURNING MACHINES

ASK ABOUT THE MONARCH DEFERRED PAYMENT AND TOOL LEASE PLANS

This NEW Manual Starter has EVERYTHING!



NEMA Sizes 0 and 1

Two, three and four-pole construction

- ***SMALLER!*** Takes less space, whether it's built into machine or mounted externally
- ***SMART STYLING!*** Matches the streamlined appearance of today's modern machines
- ***QWIK-MAKE, QWIK-BREAK!*** Positive snap-action opening and closing of contacts. Longer contact life
- ***TRIP-FREE OVERLOAD PROTECTION!*** Impossible for operator to hold motor circuit closed against overload
- ***POSITIVE PROTECTION!*** Starter will not operate *without* overload units installed
- ***LONGER LIFE!*** *Toggle Action* operating mechanism. Heavy-duty construction throughout
- ***EASIER INSTALLATION!*** Wire it without removing starter from enclosure. All terminals have pressure wire connectors

- ***EASIER MAINTENANCE!*** "Off-the-Shelf" parts kits make normal maintenance and modifications easier than ever. They're easy to buy, easy to identify, and faster to install
- ***TAMPER-PROOF!*** Cover padlocking device prevents tampering by unauthorized personnel. Safety latch locks "start" button in "OFF" position
- ***VISIBLE INDICATION OF OVERLOAD!*** Self-centering push-buttons show when overload has occurred

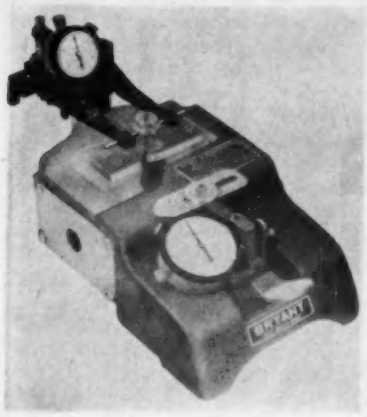
CHOICE OF ENCLOSURES:

- Water and Dust-Tight
- Hazardous Locations
- Flush Mounting

Write for BULLETIN 2510 B-C
Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin

SQUARE D COMPANY

wherever electricity is distributed and controlled



Attachment for Thread Gages Check Squareness of Face

Attachment for checking smaller parts on the B-21 Bryant-Ex-Cell-O bench-type thread gage is designed to check the squareness of faces and shoulders of parts in relation to internal or external threads or diameters of the part. Exceptional accuracy in relating squareness to threads is assured since the gaging segments hold the part firmly on the flanks of the thread in a manner similar to that of the mating part in assembly. Indicators are available with graduations reading to either 0.0005 or 0.0001 in. Accuracy and repeatability are within 0.0001 in.

This gage is adjustable vertically for different part heights. The contact arms are adjustable horizontally to suit various face diameters and contact finger adjustments provide a fine setting. The attachment is fully compensated to show total indicator readings of out-of-squareness of surfaces in relation to either internal or external threads or diameters.

Ex-Cell-O Corp, Greenville Plant, 945 E Sater St, Greenville, Ohio

MORE DATA? Circle 95, inside back cover

Linear Motion Potentiometers Available in ½-in.-dia Series

Series developed for controls and instrumentation for the metalworking, materials handling, construction, and

ARE YOU PLANNING TO BUY MORE INCOME PRODUCING EQUIPMENT?

"Talk to Talcott First"...

ABOUT LEASING, the arrangement that gives you full use of production and commercial equipment you want, without the burden of large capital investment and risks of obsolescence. A Talcott Leasing Plan lets you choose and use the desired equipment without depleting your working capital. If you can use new equipment profitably, it will pay you to "Talk to Talcott."

For booklet, "Four Keys to Business Growth," write to John Duncan, Vice Pres., Talcott Leasing Corp., 229 Park Avenue South, New York 3, N. Y.

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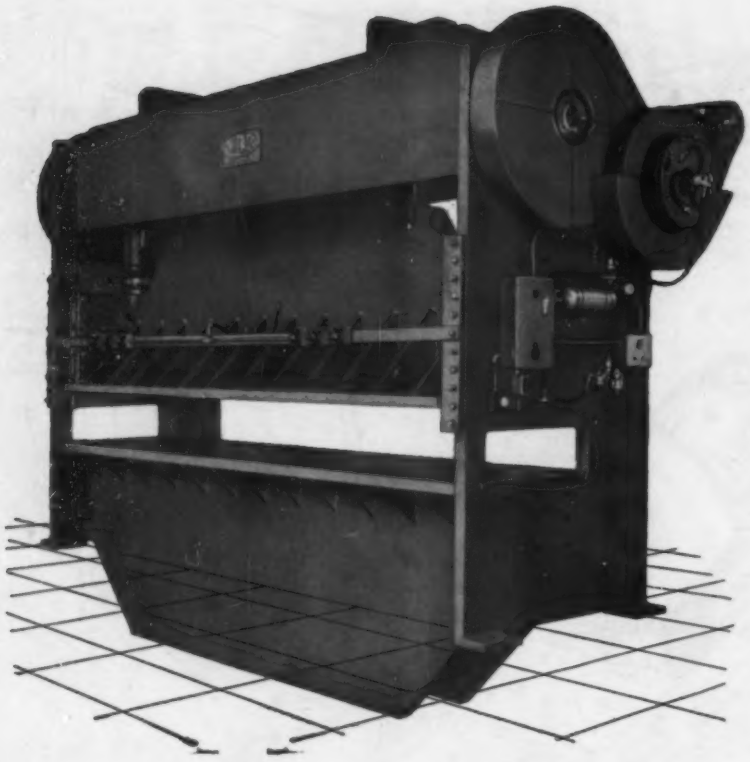


CHICAGO DREIS & KRUMP

PRESSES
STRAIGHT-SIDE TYPE

large die area
capacities up to 400 tons

This is a typical model of CHICAGO straight-side-type presses used for multiple punching, notching, and trimming operations. This press with a die area of 48 inches by 198 inches has a capacity of 200 tons.

Complete recommendations for any job on request.

8874

CHICAGO DREIS & KRUMP

Press Brakes • Straight-Side-Type Presses • Press Brake Dies
Hand and Power Bending Brakes • Special Metal-Forming Machines

DREIS & KRUMP MANUFACTURING CO.
7434 South Loomis Boulevard, Chicago 36, Illinois

production equipment fields are particularly applicable in designs with inherent space limitations and high performance, continuous-duty requirements. They can be utilized in continuous process instrumentation or direct read-out devices relating to speed, feed, thickness aad gaging controls on automatic machinery, test equipment, and prototype setups.

Each potentiometer in this series, which curently covers Markite catalog Types 3239 and 3209, offers electrical output accuracies (independent linearities) of ± 0.5% or better and is available with element resistances ranging from 1 to 20K ohms. Type 3239 has a shaft stroke length of 1.587 in. and Type 3209 a shaft stroke length of 0.600 in. Other stroke lengths can be provided

Markite Corp, 155 Waverly Pl, New York 14, NY

MORE DATA? Circle 96, inside back cover

Heavy-Duty Saber Saw Has 3-Way Blade Chuck

Saw, with 1-in. stroke length and no-load speed of 2300 spm, incorporates a rock and lock shoe which keeps the shoe flush with the work regardless of angle of cut or locks the shoe as a firm base to support the tool in scroll cutting. The blade can be mounted in three positions to cut up, down, or sideways. Double-edged blade is specially designed for making complete accurate pocket cuts in one uninterrupted operation.

The saw will make fast cuts through wood, metal, plastics, composition building materials, and pipe. It is equipped with a universal motor; spiral bevel gears; special spindle gear for safety and visibility; saw grip handle and instant-release trigger switch; extra long blade stroke. The saw is also offered in a complete kit with five blades and all standard equipment in a steel carrying box with room for extra blades and tools.

Black & Decker Mfg Co, Towson 4, Md

MORE DATA? Circle 97, inside back cover

Anaconda takes to the road with ideas for greater values and higher productivity

We're in the market with ideas. Ideas for doing new jobs—like making transistor bases and fluid-cooled conductors. Ideas for doing present jobs better—helping you match the metal to the job more precisely so that you can offer equal or greater value *and* reduce total costs.

These ideas are embodied in Anaconda's line of copper, brass, and bronze mill products, the broadest in the industry—and in the vast pool of experience and technical knowledge of Anaconda men.

To put these ideas to work we've taken to the road with a traveling value-analysis clinic, stopping in industrial centers all over the country. We've a truckload of displays representing our principal products to serve as starting points for discussions of the ideas. We're detaching specialists, technical men, mill men, executives to discuss and explain the ideas with all manufacturers who can attend the clinics.

We're also busy generating new ideas in an aggressive research and development program. And we plan to make available soon small, balanced value-analysis teams to go out in the field and work with individual company organizations—make specific suggestions and recommendations regarding materials, fabricating methods, design, etc.

Anaconda is on the move. If you have problems in which you think a new approach might help—call your Anaconda American Brass representative. Or write: Anaconda American Brass Company, Waterbury 20, Conn.

60106

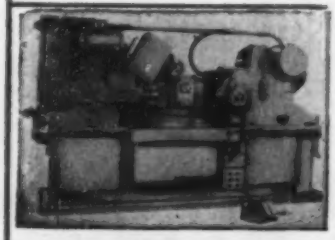
ANACONDA®

COPPER—BRASS—BRONZE
NICKEL SILVER MILL PRODUCTS

Anaconda American Brass Company

Single set-up covering
ALL finishing operations...

MEANS GREATER ACCURACY *with* **GOSS DeLEEUW**



AUTOMATIC CHUCKING MACHINES

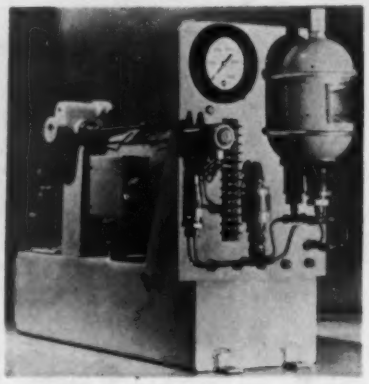
One of the many important advantages being realized with this new chucker is the performing of ALL finishing operations on a single chucking of the work. In addition to the time saved, this feature, exclusive with Goss & DeLeeuw "1-2-3" machines, means only one handling of the work with an attendant greater accuracy. This machine is in a class by itself in precision finishing.

In Goss & DeLeeuw "1-2-3" Automatic Chucking Machines, one, two, or three ends of the work are machined simultaneously or in sequence. There is no need for resetting, retooling or secondary operations. More work from one machine and greater accuracy are matters of record.

Ask for illustrated literature describing the operation of this chucker in detail. Send samples of your work for time and cost estimates.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

NEW SHOP EQUIPMENT



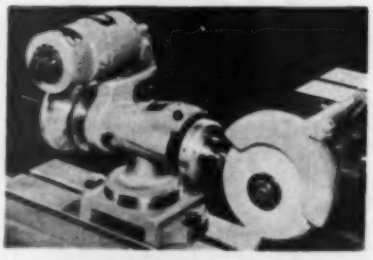
Hydraulic Power Supply Delivers 2000 psi at 0.5 gpm

Standard models of the hydraulic power supply are available over a range of 1000 to 2000 psi with hydraulic flows of from 0.5 to 1 gpm. High pressure permits the use of smaller piston areas and control valves, thereby reducing the overall size of the control system. It is particularly well suited to machine tool control applications where smaller control systems are always desired.

Pressure surges and drops during system operation are removed by a dry nitrogen accumulator. A miniature high - reliability pressure switch regulates system pressure to an accuracy of ± 50 psi. Coarse pressure control is provided by a pressure regulator. In the event of an external system failure, an electric dump valve immediately reduces system pressure to zero.

System Analysis 2305 Country Club Rd, Endicott, NY

MORE DATA? Circle 98, inside back cover



GRINDING FIXTURE is offered for cam-relief grinding and high-precision drill point sharpening. One cam is employed for RH and LH operation and is infinitely adjustable and unlimited as to number of flutes. As a drill point grinder, range covers 128 sizes from No. 80 through 1-1/32 in.—*Harig-Steptool Co, 5757 W Howard St, Chicago 48, Ill*

MORE DATA? Circle 99, inside back cover

A modern and effective solution

to machining problems connected with the manufacture of Heavy Engines, Turbines and Rolling Mills

New Milling & Boring Machine FBWS

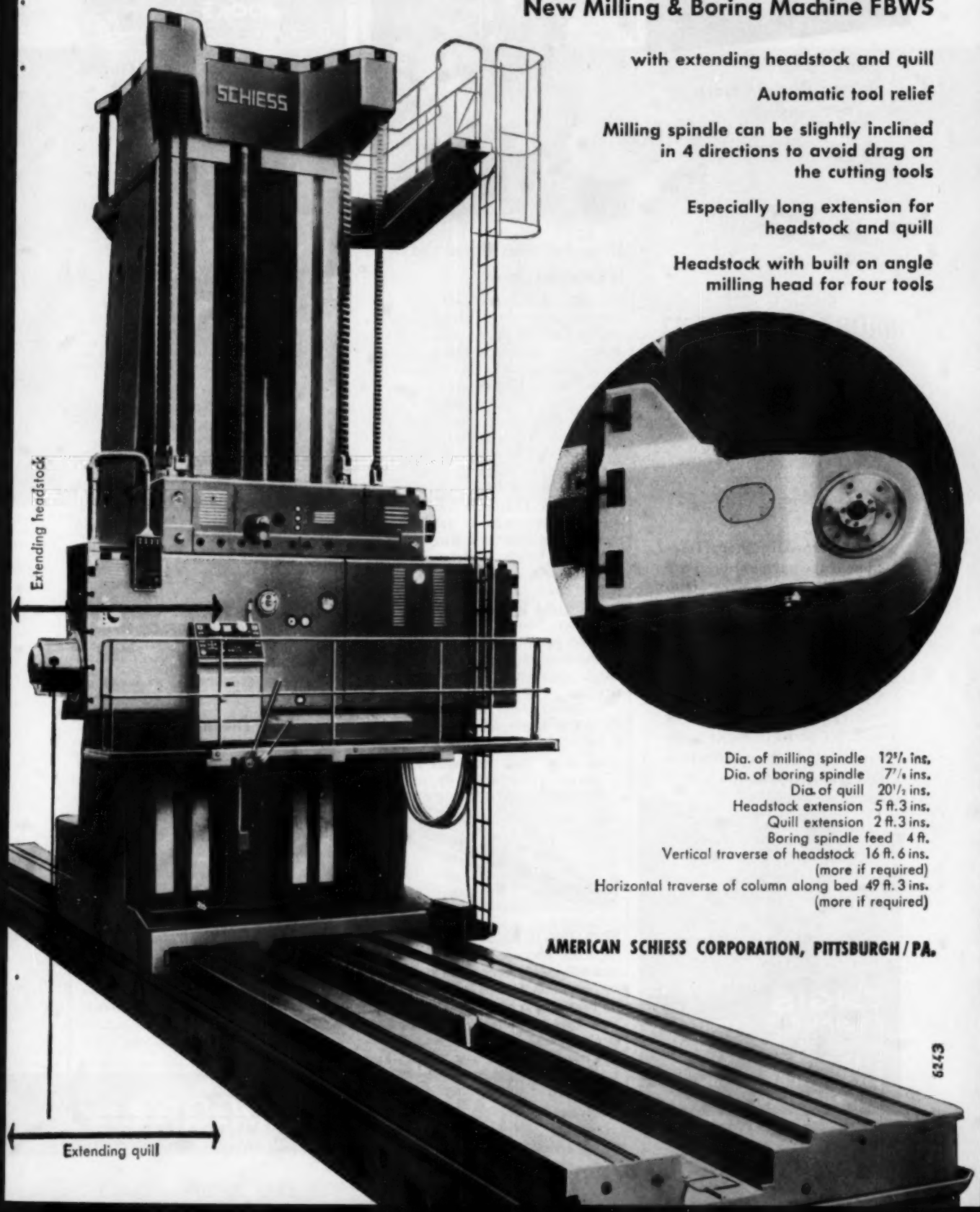
with extending headstock and quill

Automatic tool relief

Milling spindle can be slightly inclined in 4 directions to avoid drag on the cutting tools

Especially long extension for headstock and quill

Headstock with built on angle milling head for four tools



Dia. of milling spindle	12⅝ ins.
Dia. of boring spindle	7⅞ ins.
Dia. of quill	20½ ins.
Headstock extension	5 ft. 3 ins.
Quill extension	2 ft. 3 ins.
Boring spindle feed	4 ft.
Vertical traverse of headstock	16 ft. 6 ins. (more if required)
Horizontal traverse of column along bed	49 ft. 3 ins. (more if required)

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For precise alignment of all points at any distance; for establishing and checking straightness, parallelism and squareness; with full magnification of 32X or 45X, from zero to infinity.

The Micro-Alignment Telescope is the universal precision optical tooling unit for alignment of machine tools, textile and plastic machinery; for shipbuilding, missile launching, aircraft and missile assembly.

Optical micrometers read direct to .001" (standard) or .0002" (special). Right angle eyepiece and auto-reflection and auto-collimation accessories are available.

... *New*

Optical tooling publications: "Penta Prism Behavior" and "Precision Polygons" — a full treatment of the most important optical tooling accessories.

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DIVISION OF ENGINEERING AND SCIENTIFIC INSTRUMENTATION
431 SOUTH DEARBORN ST.
CHICAGO 5, ILL.

CIRCLE 254 READER SERVICE CARD

NEW SHOP EQUIPMENT

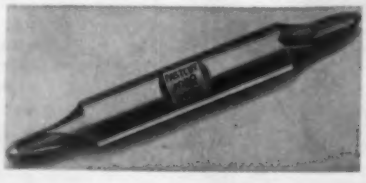
17-in. Drillpress Introduced In 84-Model Line

Features of the line include a new internal depth stop which permits stopping of the pinion at any preset depth within the full 5-in. spindle travel range. A depth gage, calibrated down to 1/16 in., and magnified 2:1 for easy reading, is attached. The depth stop completely eliminates quill, spindle, and cutting tool deflection; it also does away with hard-to-adjust stop nuts found in external types of stop rods.

There are 84 model variations to suit a wide range of job requirements. Included are single-spindle floor and bench models; multiple-spindle units and drill heads with either hand or power feed. These can be used in both high and low-speed operations. Power-feed models are equipped with a new type of mechanical feed permitting one-hand engagement for production drilling.

Walker-Turner Div, Rockwell Mfg Co, 400 N Lexington Ave, Pittsburgh 8, Pa

MORE DATA? Circle 100, inside back cover



STUB LENGTH BALL N-MILLS, designed for those who use the ball end of the tool only, or a very small part of the cut, permit increased feeds and speeds by providing a more rigid cutting tool. They have two flutes and are available in either single or double end. Diameters are 1/8, 3/16, and 1/4 in.—*Fastcut Tool Co, 25425 Mound Rd, PO Box 395, Warren, Mich*

MORE DATA? Circle 101, inside back cover

Checklist of helpful
McGRAW-HILL BOOKS

PRINCIPLES OF MANUFACTURING MATERIALS AND PROCESSES
Just Out. Modern production-proved practices for solving manufacturing problems quickly and easily. By J. Campbell, Univ. of Calif. 668 pp., 459 illus., $9.75

PETROLEUM PRODUCTS HANDBOOK
Covers properties, characteristics, performance of all types of petroleum products . . . and how to best use them. Edited by V. Guthie, formerly *Petro. Process.*, and *Natl. Petro. News*. 864 pp., 459 illus., $18.50

FREE MAN AND THE CORPORATION
A top executive describes what the corporation means to a free man, why it exists, how it operates. By R. Blough, Chairman of the Board, U.S. Steel Corp. 140 pp., $4.50

THEORY OF METAL CUTTING
Just Out. Explains mechanics, economics, and methods of modern metal cutting to help you specify machining operations—increase production. By P. Black, Ohio Univ. 216 pp., 126 illus., $7.50

HOW TO SUPERVISE PEOPLE
Helps you analyze your job and apply correct methods of handling supervisory problems. Covers hiring, reprimanding, delegating, training, and other areas. By A. Cooper, Indus. Consult. 4th Ed. 310 pp., $4.95

DIMENSIONAL CONTROL IN PRECISION MANUFACTURING
How dimensional control techniques are applied in production machining to increase production and reduce unit costs. By J. Gadzala, Boeing Airplane Co. 205 pp., 156 illus., 7.50

TOOL ENGINEERS HANDBOOK
Data on the design, fabrication, maintenance, and economical use of industrial tools and machinery. By ASTME, P. Wilson, Editor-in-Chief. 2nd Ed. 2150 pp., 2000 illus., $19.50

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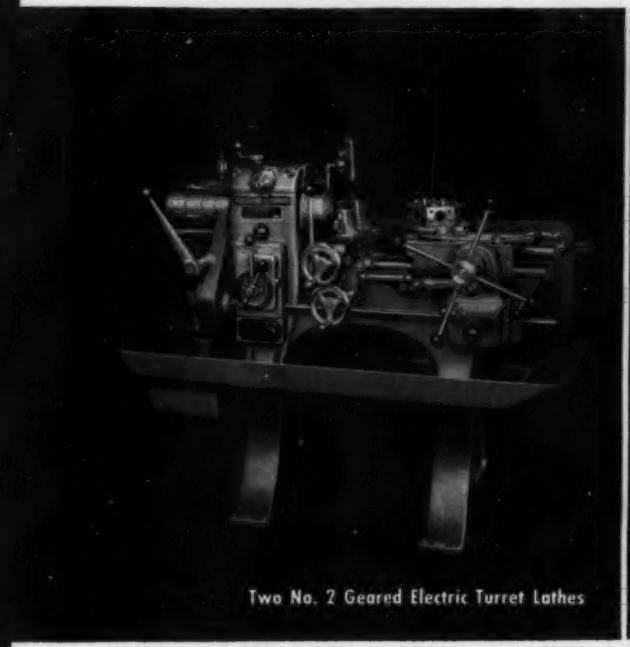
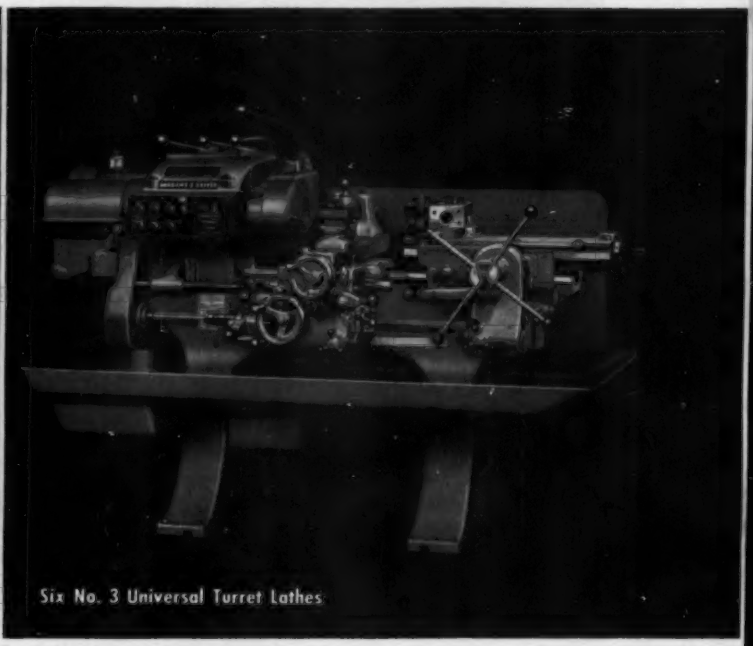
CIRCLE 255 READER SERVICE CARD

KENT-MOORE KEEPS MODERNIZATION PROGRAM ON SCHEDULE...



Two No. 2 Geared Electric Turret Lathes



Six No. 3 Universal Turret Lathes

ADDS 8 NEW BARDONS & OLIVER TURRET LATHES DURING LAST SEVEN YEARS

Why does the world's largest manufacturer of special automotive service tools consistently select Bardons & Oliver Turret Lathes?

We asked K/M's plant engineer, A. S. Adamczyk and he stated as follows:

"We specified B & O Lathes because:

From past experience, we know they set-up quick, adapt easily to our needs, and require little maintenance.

Our operators prefer their simplified, properly placed controls, short turret-index motion, easily moveable tool-carrying units —and best of all, their ability to hold exacting tolerances.

They consistently cost less than other turning equipment in both initial investment and modification expenditures necessary to adapt them to our special needs.

In short, Bardons & Oliver Lathes meet our most demanding requirements and we are 100% satisfied with their performance."

For detailed information on the complete line of B & O machines, call the Bardons & Oliver representative in your area or write directly to our home office.

Bardons & Oliver, Inc., 1133 West 9th Street
Cleveland 13, Ohio

LATHE OPERATIONS AT KENT-MOORE

Using a two-shift (16 hours) daily operation, over 5,000 different jobs are handled each year, 200 of which are entirely new projects. Parts are machined from a wide variety of materials, brass to high-alloy steels, in lot sizes from 25 to 7500 pieces. In some cases tolerances of ± .0005 are required.

BARDONS & OLIVER

Manufacturers of Turret Lathes and Cutting-Off Lathes

A LABORATORY IN JOHANNESBURG IS WORKING FOR YOU

Possibly you have never even heard of the Diamond Research Laboratory of Johannesburg. Yet its findings are of great importance to every user of industrial diamonds.

Established in 1947, the Diamond Research Laboratory is sponsored by Industrial Distributors (1946) Ltd. Its work is devoted exclusively to investigations on all phases of the diamond.

In its brief 13 years of existence, the Laboratory's developments have been of great significance. They include:

- increase in efficiency of natural diamond grit in resin and metal-bond grinding wheels
- considerable improvement in design and performance of diamond drill crowns
- development of electrolytic method of resharpening tungsten-carbide-tipped percussion drill bits
- development of diamond thermistors for highly accurate temperature measurements
- vector orientation, by X-ray, of diamond tool stones

Obviously, this intensive—and costly—research cannot be carried on by individual users of industrial diamonds. But Industrial Distributors, world distributors of natural industrial diamonds, has undertaken this responsibility for interested users throughout the world.

The Diamond Research Laboratory is in Johannesburg. But it's working for *you*.

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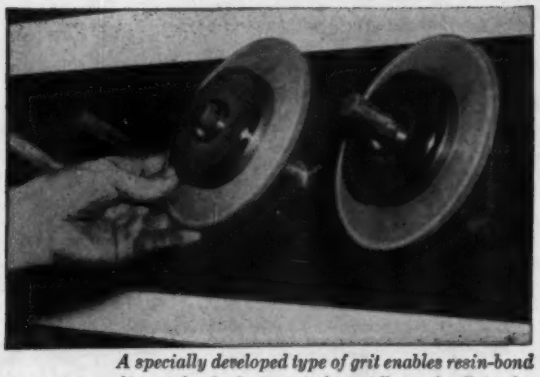
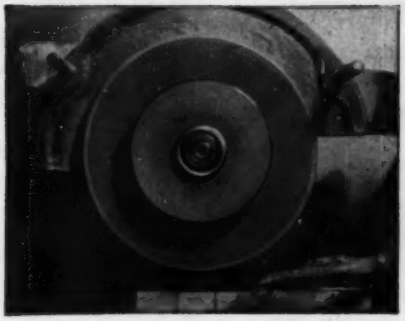
Resin-bonded diamond grinding wheels are tested in a carefully controlled experiment. In two years of testing, 450 separate wheels were used to grind away two tons of carbide.

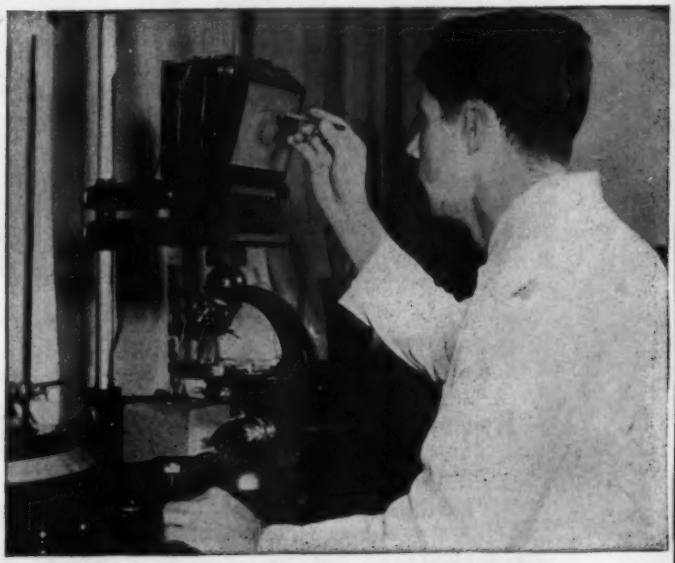


A specially developed type of grit enables resin-bond diamond wheels to grind rapidly and efficiently.

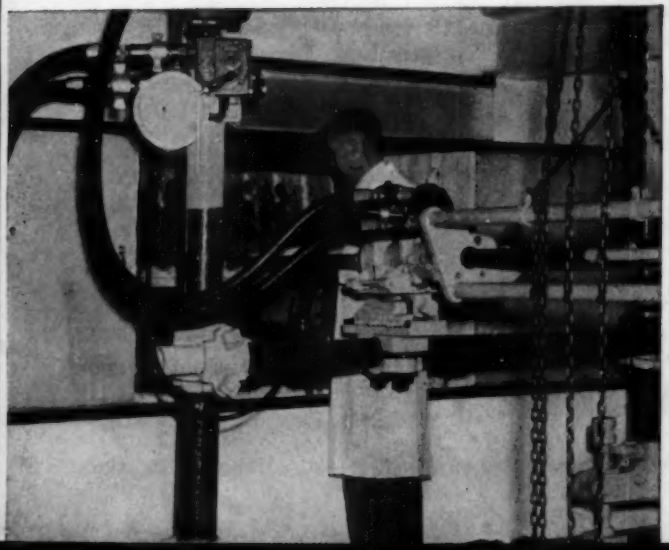


A diamond abrasive wheel is tested at the Diamond Research Laboratory by surface grinding a block of tungsten carbide.

Staff member counts number of diamond grit particles which appear on the screen of a microscope. This instrument was especially developed for checking the shape of diamond grit.



Laboratory drilling machine tests the efficiency of diamond drill crowns in granite.



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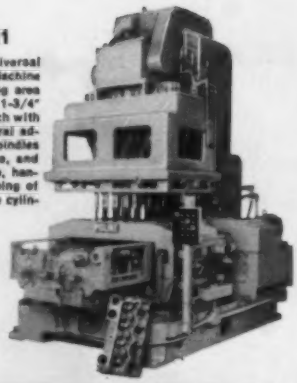
MODEL HU111

Hydraulic Feed, Universal Joint-Type Drilling Machine with 24" x 30" drilling area and with forty-two 1-3/4" spindle drivers, each with two-speed and neutral adjustment. Thirty-six spindles in slip spindle plate, and power shifting fixture, handle drilling and reaming of three different engine cylinder heads.



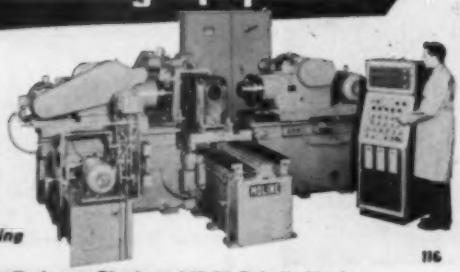
HD13

straight line drilling machine with hydraulic table feed and 18 spindles each having 11/16" diameter drill capacity in mild steel. Spindle center distances are adjustable along the 6-foot machine rail.

MOLINE Cost Reducing Equipment

MODEL MR148

Three-way, three-spindle, horizontal boring machine with selective automatic feed cycle. Handles boring of cylinder and crank bore for 3 sizes of 1-cylinder blocks. Also bores for wet sleeves in 2- and 3-cylinder blocks.



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- Multi-Spindle Boring • Single and Multi-Spindle Honing
- Straight Line Multi-Drilling • Adjustable Spindle Drilling
- Special Multiple Operation Machine Tools *Write for Details*

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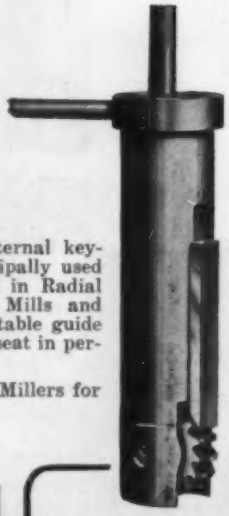
REPRESENTATIVES IN PRINCIPAL CITIES

CIRCLE 259 READER SERVICE CARD

THE KEY TO BETTER KEYSEATS

NATIONAL
Keyseating Millers



NATIONAL Keyseating Millers are mechanically simple in construction, sturdily built, designed for milling internal keyseats, faster and better. Although principally used in Drill Presses they can also be used in Radial Drilling Machines, Horizontal Boring Mills and Milling Machines. An exclusive demountable guide on body of Miller assures a straight keyseat in perfect alignment with axis of bore.

You can depend on National Keyseating Millers for all your keyseating jobs.

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WRITE TODAY
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complete, handy size

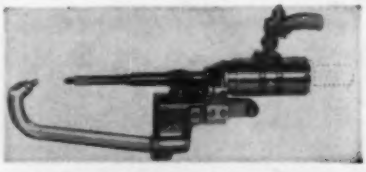
Extension Set Increases Range Of Truarc Groove Location Gage

The gage is designed to measure the distance from the outer wall of a beveled or rectangular groove to a plane of reference 0.4 to 1.4 in. from the groove wall. With a set of four extensions the range may be increased from 1 to 11 in. Made of hardened tool steel, they are 1, 2, 3, and 4 in. in length and may be used individually, in combinations of varying length, or with all four attached to the gage spindle. Knurled ends simplify attaching and removing from the gage.

The fitted case illustrated is available for an additional charge for holding gage, extensions, and the micrometer wrench which is supplied. Prices are: gage (without extensions or case) $42.50; set of four extensions, $24; case, $4.75.

Waldes Kohinoor Inc, Truarc Retaining Rings Div, 47-16 Austel Pl, Long Island City 1, NY

MORE DATA? Circle 102, inside back cover



Portable Welding Guns Have New, Compact Design

C-Type Craft gun illustrated is one of a line that includes scissors, bellcrank, expansion, and fixture-type units, all assembled from a minimum of interchangeable standard parts.

Dotted lines indicate the amount of bulk saved by the compact design of the retraction cylinders. Size reduction simplifies handling in close quarters. Mounting holes for attaching accessory bails or hangers are located at optimum balance points.

Kirkhof Mfg Corp, 2450 Buchanan Ave SW, Grand Rapids 7, Mich

MORE DATA, Circle 103, inside back cover

Master Power's NEW Air Saw Cuts Anything, Any time, Anywhere

Photographed at Florida Silver Springs

12 WAYS BETTER than any portable saw you ever used...

- No gears.
- No windings, no stators, no shock factor, no deterioration.
- Lighter weight, compact.
- Fully adjustable to 2-11/16" depth of cut; 2" for 45° angle cuts.
- Safer—no coasting on shut-off; no loading up of saw teeth.
- Quiet in operation—loudest noise is the cutting.
- Controlled direction of exhaust to muffler or to blade for cooling.
- Governor controlled for safety—no burn out in event of stall.
- Low weight vs. horsepower ratio—6000 rpm.
- Big 8¼" diameter combination blade.
- Easily dismantled for service.
- Totally enclosed air motor with over 14 years of proven field use.

Use it on your toughest cutting jobs—the proof is in the performance! This #408 portable air saw is the latest addition to the Master Power line of precision-built, quality air tools. Not only will this lightweight, easy-to-handle tool out-perform anything you've ever used before, but also it brings you safety advantages no other portable saw can offer: little coasting on shut-off; no loading up of saw teeth; no shock factor; no deterioration; to name a few. (Not that you'll ever have to, but you can even use it under water!)

The new Master Power #408 cuts most anything—sheet steel, corrugated roofing, channel iron, bar stock, wood, aluminum, cast iron, and more. Comes complete with carrying case and rip fence. Mail coupon for a free demonstration or additional information. *Leading distributors everywhere.*

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MP Master Power

A **Black & Decker** Subsidiary

LOOK UNDER TOOLS—PNEUMATIC

MASTER POWER CORPORATION, Dept. 7-021, Solon, Ohio

☐ Free demonstration ☐ Added information

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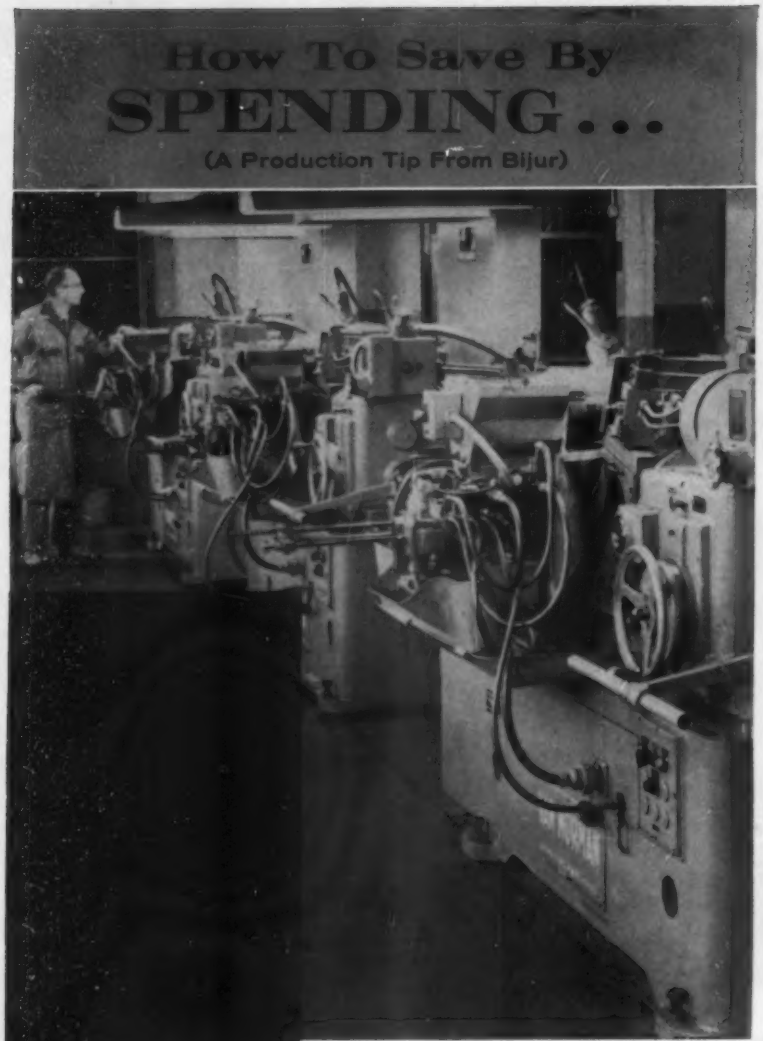

Walk down your production line and you'll see your machines equipped with Bijur Automatic Lubricating Systems outproducing machines with manual lubricating. If you can spot the difference, so can your Cost Accounting.

Only a little time and money are needed to convert *all* of your machines to Bijur Automatic Lubrication. Figure out the savings brought about by this improved efficiency, and ask Bijur to help you determine how fast the cost of Bijur equipment can be amortized.

As more equipment manufacturers turn to Bijur, this replacement problem will disappear. Your first step, for now, is to write for descriptive literature. Next step: Put the savings in your pocket.

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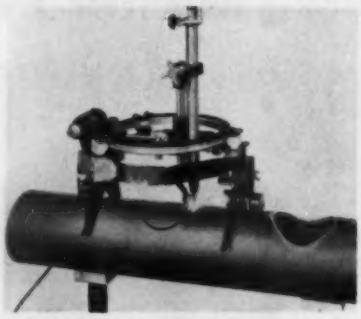


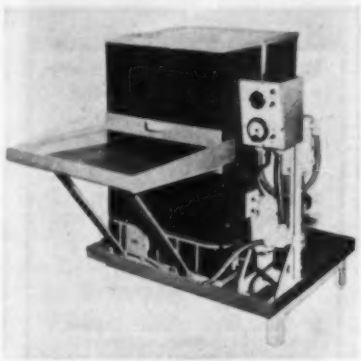
90° Hole Cutter Furnished In Three Sizes

Model ST, designed for cutting 90° holes in pipe, tanks, and flat plate, is available in three sizes for cutting perpendicular holes up to 18 in. in diameter without cams, patterns, or layouts. This lightweight machine may be used with electric drive or may be completely hand-operated in the field.

Cutting is accomplished with an oxygen, acetylene torch arrangement which is reported to overcome many of the difficulties encountered with previous methods; edges are said to be clean, burr-free, and to have excellent weldability. Grinding is unnecessary since little slag is accumulated. Machine is powered through its cycle with a variable speed electric motor at the correct speed relative to the thickness of the metal.

Steffan Mfg Corp, 1585 S Lincoln Ave, Salem, Ohio

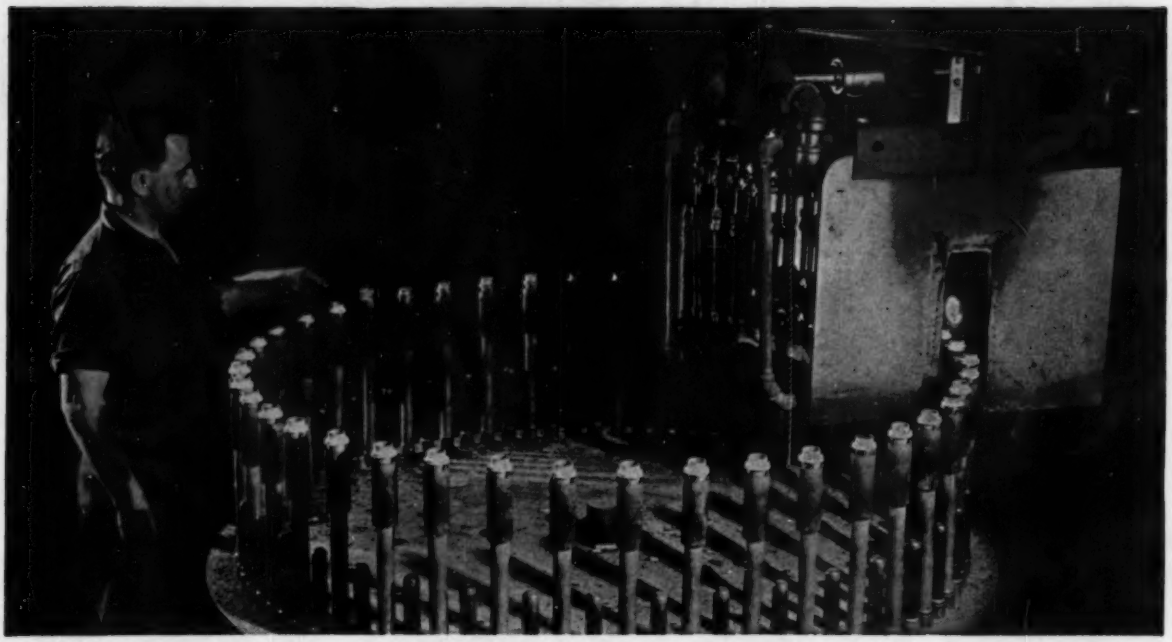
MORE DATA? Circle 104, inside back cover



Printed Circuit Boards Etched On Both Sides Simultaneously

Model 700 horizontal, double-sided spray etching machine is designed for fast, efficient etching of double or single-sided printed circuit boards and nameplates, and for chemical machining. Features of the unit which uses all common etchants, include horizontal, two-sided, oscillat-

Every Hour M. S. Little Brass Goods Company Makes 650 Appliance Fittings Better With HANDY & HARMAN SILVER BRAZING



Rotating jig showing mounted assemblies entering and leaving gas-air furnace.

Left– brazed assembly. Right– components with preform ring of EASY-FLO *45.*

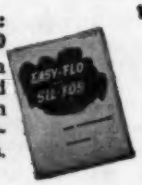
This Hartford, Connecticut, company makes—in volume—an assembly that goes into the overflow system of household appliances. The assembly consists of brass tubing and a machined brass casting. The two components are joined by a preplaced ring of Handy & Harman EASY-FLO 45 silver brazing alloy and HANDY FLUX. Heating is automatic gas-air; parts are placed on a rotating turntable to pass through the gas furnace. Every 60 working minutes, 650 assemblies are completed.

The advantages here are that the manufacturer can use thin-walled tubing with heavier, threaded components at no sacrifice in strength. Because of EASY-FLO's penetrating qualities, the entire shear area is fully as strong as the solid parts of the assembly, yet considerably lighter. And, casting and machining the components for this assembly have been greatly simplified.

Are you in pursuit of a metal-joining method which offers—among other advantages—high, uninterrupted production at low capital investment? You may easily find the answer in Handy & Harman silver brazing. Hundreds of manufacturers and fabricators of as many different products, parts and components are right now enjoying the speed, economy, strength and *flawlessness* of brazing. You can too. Just ask Handy & Harman, 82 Fulton Street, New York 38, N. Y.

FOR A GOOD START: BULLETIN 20

This informative booklet gives a good picture of silver brazing and its benefits... includes details on alloys, heating methods, joint design and production techniques. Write for your copy.



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The IMPROVED CECO-DROP

with CECO BLOWMATIC PROGRAM CONTROLLER
(illustrated below)
Pre-selected pattern of long and short strokes for Semi-automatic Forging

Other great new features:

DIE SETTING EASIER AND SAFER: by means of new ram-inching device, operator can raise or lower ram, safely at will.

FASTER ACTING ROD CLAMP: by means of new Double-acting Clamp Operating Cylinder.

WEAR-REDUCING NYLON-TIPPED KNOCK-OFF DOG: reduces shock to valve control rigging; reduces wear on ram incline.

Write for bulletins and details

CHAMBERSBURG ENGINEERING COMPANY • CHAMBERSBURG, PA.

CHAMBERSBURG

• The Hammer Builders •

DESIGNERS AND MANUFACTURERS OF THE IMPACTER

When it's a vital part, design it to be FORGED

ing spray etching; fine lines etched with exceptional uniformity over entire board in less than two minutes using ferric chloride; drawer-type work-holding rack at waist height.

Board sizes are up to 16 x 19½ in.; etchant capacity is 24 gal; controls are a 15-minute electrical reset timer for etchant pump, thermostat for immersion heater, overtemperature safety control; size is 37 x 48 x 47 in. high.

Centre Circuits Inc, PO Box 165, 1101 N Atherton St, State College, Pa

MORE DATA? Circle 105, inside back cover

Transistor Welding Machine Concentrates Weld Pressure

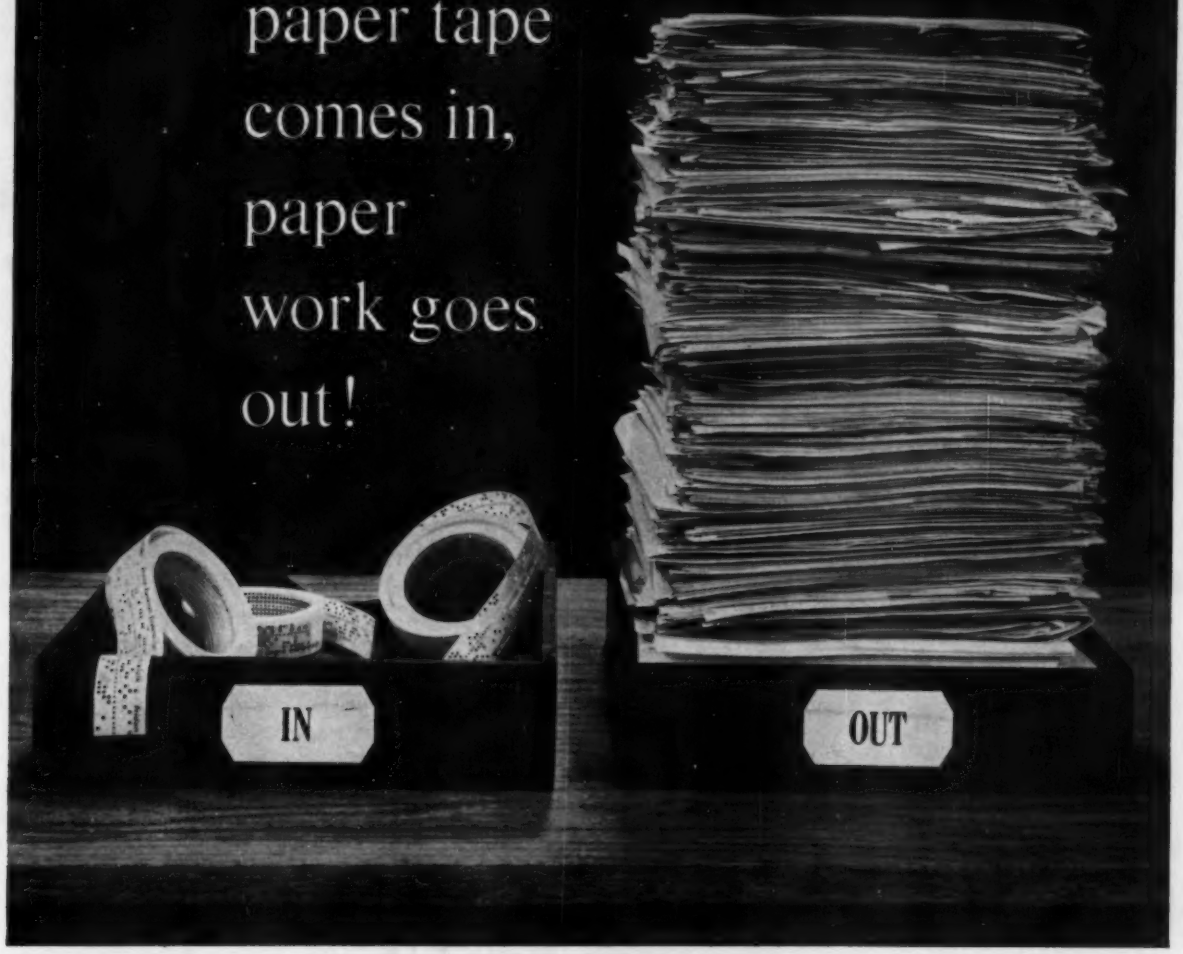
Model 250 projection welding machine for welding TO-18 and smaller type transistors is designed to improve the concentration of weld pressure around an extremely narrow lip on transistor caps, and to overcome pressure drag that occurs at the moment of upset. The unit is a two-post, direct tension type with a low inertia, springloaded assembly acting as the lower electrode.

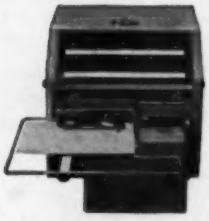
Frame, available in either a 5 or 10-kva rating, consists of two vertical steel columns attached at both ends to two horizontal 4-inch channels, one 9½in. above the other. If desired, it may be mounted within a controlled atmosphere chamber. Welding electrodes are located midway between the columns. Transistor components, therefore, are located in the machine at a point directly in line with the welding force. The work dies also are more accessible than those in other models. Welding pressure is applied through the top electrode by a 2⅛-in.-dia air cylinder having a 1⅞-in. stroke. This cylinder mounts on the top channel and operates on 80-psi air.

Thomson Electric Welder Co, 161 Pleasant St, Lynn, Mass

MORE DATA? Circle 106, inside back cover

Collectadata: when paper tape comes in, paper work goes out!





The machine at left is a Friden Collectadata® Transmitter, key to a new system of internal data collection that virtually eliminates in-plant paperwork.

The system is very simple. Transmitters, spotted in key reporting locations throughout the plant, are cable-connected to a central Collectadata Receiver. "Blank forms" are issued as pre-coded tab cards or Friden edge-punched cards. Each card becomes a "filled-in" report after the worker inserts it in the transmitter, dials in any variables and touches a key. The rest is automatic. The receiver records each report in punched paper tape, adds an automatic time code. At day's end, the receiver tapes are processed—converted to tab cards or fed into a computer to prepare complete operations reports.

Collectadata users report substantial savings in time and money. But in many applications the *speed, accuracy and efficiency* of automated data collection are even more significant. For information, consult your local Friden Systems Man. Or write: Friden, Inc., San Leandro, Calif.

THIS IS PRACTIMATION: automation so hand-in-hand with practicality there can be no other word for it.

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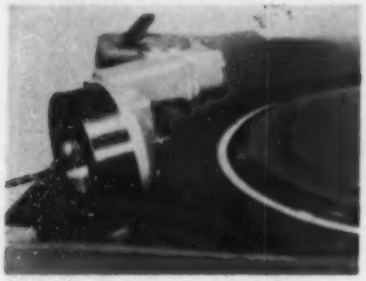
Friden

SALES, SERVICE AND INSTRUCTION THROUGHOUT THE U.S. AND WORLD



New Workheads Add to Versatility Of Winslo-Matic Drill Pointer

Additional accessories for the Model 100-A Winslo-Matic drill point grinder include standard type workheads for pointing the Winslow Type 4 drill points (or other helical, self-centering points), split points, and conventional points on drill sizes from 0.032 through 1.50 in. Two crankshaft workheads are also available for producing precision crankshaft or split points on 0.093 through 1.0-in.-dia drills on a production basis. An additional crankshaft workhead will soon be available for crankshaft operations on drills up through 1.50-in. diameters.

Manufacturer states that carbide drills can also be sharpened on a production basis, as well as special cutters such as two-flute end mills 180° bottoming drills, drill points on most drill countersinks, mill cutters and special end grinds.

Winslow Product Engrg Corp, 47 St Joseph St, Arcadia, Calif

MORE DATA? Circle 107, inside back cover

Power Drill Series Offered in Short Lengths

Short length power drills, available in fractional and wire gage sizes, are of the same specifications as screw machine drills except for specially designed, heavier webs which make them especially suited for use in portable machines. They will reportedly stand considerable strain.

Whitman & Barnes, 40600 Plymouth, Mich

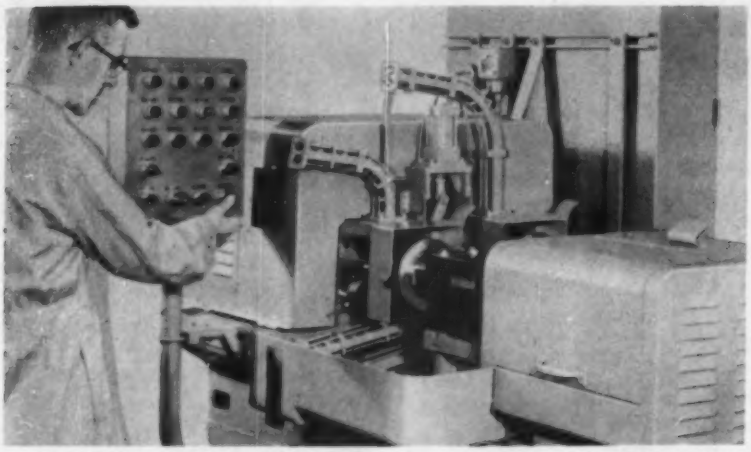
MORE DATA? Circle 108, inside back cover

Mauser Dial-Reading Caliper Has 5-in. Measuring Capacity

Scherr-Tumico dial caliper is furnished with plexiglass protected green dial reading directly to 0.001 in. and precision measuring roller and lockscrew for external, interna', and depth measurements. Additional features include outside jaws with knife-edge blades, crosshorns with knife-edge points for bore measurements, slide with depth rod, spring-hard beam, glass-hard jaws and horns, lapped measuring faces, adjustable phosphor bronze slide spring. Price is $34.50.

Dist by Scherr-Tumico, 200 Lafayette St, New York 12, NY

MORE DATA? Circle 109, inside back cover



AUTOMATED PRECISION BORING MACHINE finish bores the internal diameter of automotive transmission planet carrier pinion blanks at nearly 400 parts an hr. Accuracy of bore size is held to within 0.0006 in. while bore is held square to faces of part within 0.0003 in. A quill with micrometer adjustment aids rapid and accurate tool setting—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich*

MORE DATA? Circle 110, inside back cover

ASARCON

DISTRIBUTORS for ASARCON CONTINUOUS-CAST BRONZE:

ALABAMA
Birmingham
Dixie Bronze Co., Inc.
FA-4-4508
J. M. Tull Metal & Supply Co., Inc.
FAIRFAX 3-1612
ARKANSAS
Little Rock
Arkansas Foundry Company
FRANKLIN 2-6261
CALIFORNIA
Los Angeles
Kingwell Bros., Ltd.
LUDLOW 2-7427
San Francisco
Kingwell Bros., Ltd.
SUTTER 1-0514
CONNECTICUT
Guilford
Knapp Foundry Co., Inc.
GLENDALE 3-2744
Seymour
The Derby Castings Co.
TUXEDO 8-2581
Stratford
The Ellsworth Industrial Supply Co.
EDISON 7-3317
FLORIDA
Jacksonville
J. M. Tull Metal & Supply Co., Inc.
EVERGREEN 7-5561
Miami
J. M. Tull Metal & Supply Co., Inc.
OX 6-0150
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TAMPA 3-6741
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Atlanta
J. M. Tull Metal & Supply Co., Inc.
JACKSON 5-3871
ILLINOIS
Chicago
Bearing Headquarters Co.
Div., Ray M. Ring Co., Inc.
ESTERBROOK 9-0300
Bronze Bearings, Inc.
JUNIPER 3-1100
Peoria
Ray M. Ring Bearing Co.
PEORIA 6-73-8171
Rockford
Rockford Tool & Transmission Co.
ROCKFORD 2-7751
Waukegan
Bearing Headquarters Co.
Div., Ray M. Ring Co., Inc.
MA 3-5212
INDIANA
East Chicago
Bearing Headquarters Co.
Div., Ray M. Ring Co., Inc.
E. CHICAGO EX 7-8020
SAGINAW 1-8660
Indianapolis
Jones & Laughlin Warehouse Div.
Jones & Laughlin Steel Corp.
MELROSE 1-8811
South Bend
Powell Tool Supply, Inc.
ATLANTIC 9-5578
KENTUCKY
Louisville
Williams & Co., Inc.
JUNIPER 3-7781
LOUISIANA
New Orleans
Standard Brass & Mfg. Co.
AUDUBON 1381
Shreveport
Standard Brass & Mfg. Co.
UN 5-4241
MARYLAND
Baltimore
Bronze Specialties, Inc.
LEXINGTON 9-1906
MASSACHUSETTS
Boston
Keico Metal Products Co.
HUBBARD 2-1737
Millard Brass & Copper Co.
HIGHLANDS 2-6220
MICHIGAN
Detroit
Copper & Brass Sales, Inc.
FOREST 5-6200
Maier Brass & Aluminum Co.
JORDAN 6-3907
Grand Rapids
Copper & Brass Sales, Inc.
EMPIRE 1-6681
Kalamazoo
Bord Tool and Equipment Co.
FIRESIDE 3-2691
Lansing
Superior Brass & Aluminum Co.
IV 2-2754
Muskegon
Towne Hardware & Supply Co.
7-2691
MINNESOTA
Minneapolis
R. G. Eide, Inc.
FE 8-4846
MISSOURI
Kansas City
Associated Bearings Co.
HARRISON 1-5407
St. Louis
R. J. Bearing Co.
MISSION 7-3605
NEBRASKA
Grand Island
The Island Supply Co.
DUPONT 2-8567
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T. S. McShane Co., Inc.
JACKSON 1273
NEW JERSEY
Carlstadt
E. A. Williams & Son
GENEVA 8-0800
MARKET 3-1929
(New York LA 4-9546)
Newark
Federal Bronze Products, Inc.
MARKET 2-6330
Perth Amboy
Gregg's Brass Foundry
HILLCREST 2-2080
NEW YORK
Brooklyn
Hamsley, Inc.
STerling 8-1144
Buffalo
Koncraft Associates, Inc.
RIVERSIDE 1520
Rochester
Ontario Metal Supply, Inc.
HAMILTON 6-1430
Syracuse
Meloon Bronze Foundry, Inc.
GLENVIEW 4-3231
Troy
The Troy Belting & Supply Co., Inc.
AS 2-4920 (in Albany 3-6121)
OHIO
Akron
Akron Welding and Spring Co.
JEFFERSON 5-2187
Cleveland
Copper & Brass Sales, Inc.
VU 3-8100
The Bearing Bronze Co.
MICHIGAN 1-6520
Cincinnati
Reliable Castings Corp.
KIRBY 1-2627
Columbus
Williams & Co., Inc.
AXMINSTER 4-1623
Dayton
The Bristol Brass Corp. of Ohio
BALDWIN 8-8185
Toledo
The Seegar Brass Company
CHERRY 8-5321
Williams & Co., Inc.
GREENWOOD 5-8651
PENNSYLVANIA
Easton
R. T. Schaller Co.
BL 2-2435
Latrobe
Latrobe Foundry Machine & Supply Co.
KEYSTONE 7-3341
Philadelphia
Brass & Copper Sales, Inc.
GLADSTONE 7-2500
Renewal Service, Inc.
BALDWIN 9-6330
Pittsburgh
Pennsylvania Industrial Supplies Co., Inc.
ALLEGHENY 1-5010
Pittsburgh Brass Mfg. Co.
ATLANTIC 1-8761
RHODE ISLAND
Providence
Clifford Metal Sales Co., Inc.
UNION 1-4100
SOUTH CAROLINA
Greenville
J. M. Tull Metal & Supply Co., Inc.
CEDAR 3-8366
TENNESSEE
Memphis
Memphis Bearing & Supply Co.
JACKSON 6-7543
Nashville
Dixie Bearings, Inc.
CHAPEL 2-7351
TEXAS
Beaumont
Standard Brass & Mfg. Co.
TERMINAL 3-2641
Houston
Standard Brass & Mfg. Co.
RI 7-1220
Port Arthur
Standard Brass & Mfg. Co.
YUKON 5-9377
WISCONSIN
Milwaukee
Badger Bearing Co.
BROADWAY 2-0231
CANADA
Lachine, Quebec
Federated Metals Canada, Ltd.
MELROSE 7-3591
Scarborough, Ontario
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PLYMOUTH 7-3246

ASARCON

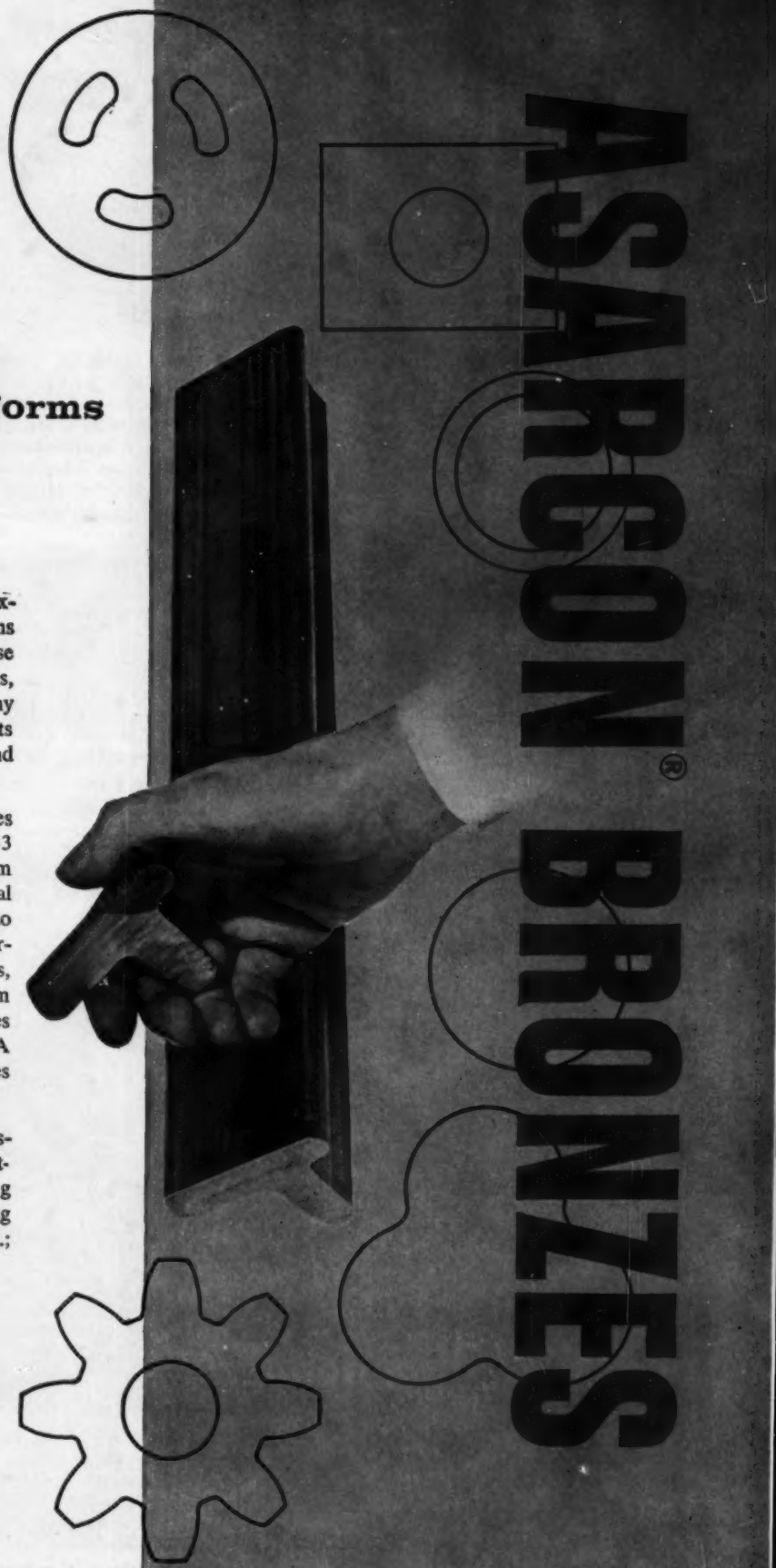
custom shapes and forms in any lengths you need

Asarcon continuous castings give you an extremely wide variety of shapes and forms in standard bronze alloys. They will increase your production rates and lower your costs, because: you get the shape you want in any length you need up to 20 feet. This permits machining on automatic screw machines and other high-speed equipment.

Continuous casting of Asarcon bronzes raises fatigue characteristics of standard alloys 33 to 100%, increases impact strength from 15% to more than double that of identical alloys cast other ways, adds materially to tensile, yield strengths and hardness. Asarcon 773 (SAE 660) bearing bronze in solids, rods and tubes is immediately available from stock in your choice of more than 260 sizes up to 9″ O.D. and lengths up to 105″. A wide variety of other special alloys, shapes and sizes produced to order.

For complete data on Asacon continuous-cast bronze, write Continuous-Cast Department, American Smelting and Refining Company, Perth Amboy, N. J.; Whiting Ind., or 120 Broadway, New York 5, N. Y.; or call your nearby Asarcon distributor.

ASARCO



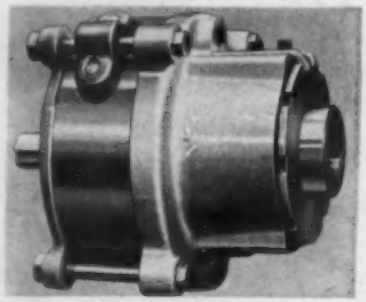
CIRCLE 267 READER SERVICE CARD

Tools stay sharp longer with Multi-Mister on the job

Forming and cutting tools last longer, stay sharper, produce better finishes when cooled and lubricated with DeVilbiss Multi-Mister. Adjustable for heavy or fine mist spray; swivel tip permits pinpoint aiming. Exclusive nozzle design provides instant spray for intermittent cycling. Get full details. Write: The DeVilbiss Company, Toledo 1, Ohio. Offices in principal cities.

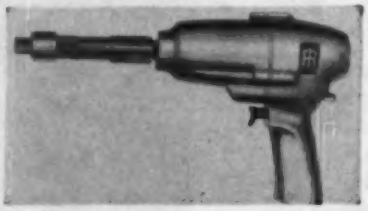
FOR TOTAL SERVICE, CALL

DEVILBISS



PLANETARY GEAR REDUCER, shaft-mounted, with ratios from 3½:1 to 36:1 and in a horsepower range from 4 to 30, is said to offer up to 50% savings in weight and space. It is available in either steel or aluminum housing — *Crichton Co, Johnstown, Pa*

MORE DATA? Circle 111, inside back cover



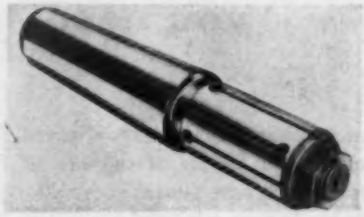
Torque Control Impactools Have Detachable Torsion Bars

Two new Impactools incorporate detachable torsion bars to increase the speed and accuracy of driving nuts, bolts, and capscrews to a variety of precise torques. To change the torque delivered by either tool, the operator simply snaps on a different preset torsion bar.

Each tool is available with heavy and light torsion bars. The light torsion bar for the 5040TD Impactool may be set for torques from 20 to 50 ft-lb; the heavy torsion bar covers from 45 to 90 ft-lb. Similarly, the light and heavy bars for the 5020TD Impactool may be set for 6 to 17 ft-lb and 10 to 30 ft-lb. Through use of several torsion bars, each preset for a desired torque, one Impactool will handle a variety of torques.

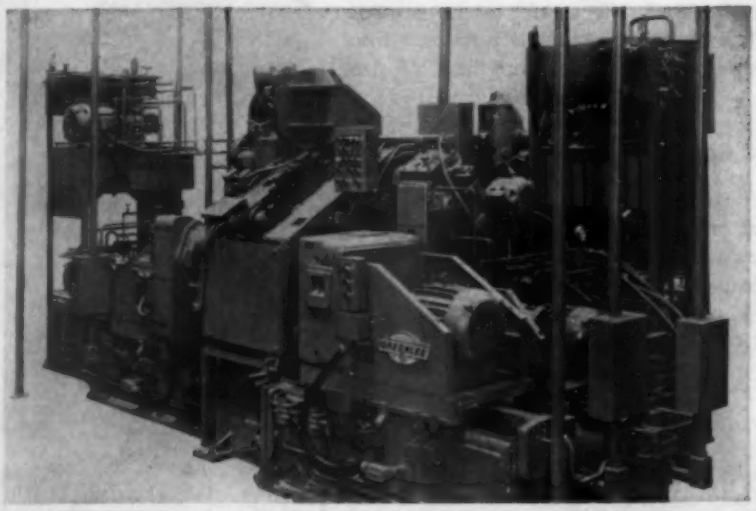
Ingersoll-Rand Co, 11 Broadway, New York 4, NY

MORE DATA? Circle 112, inside back cover



PERMAN EXPANDING MANDREL can be used for internal chucking on ID's from ⅜ to 4½ in. with a maximum run-out of 0.0004 in. Standard shanks include NMTBA, Morse, B&S and straight. Change of workpieces is quick since nut and collet form a unit— *Homestrand Machine Tool Corp, 392 W Putnam Ave, Greenwich, Conn*

MORE DATA? Circle 113, inside back cover



FOUR-WAY, FOUR-STATION HORIZONTAL automatic indexing machine produces 660 cast iron cylinders an hr. Four pieces are power-clamped in station one and move through the four stations in 17.4 sec. Machine has two hydraulic controlled centers—*Greenlee Bros & Co, Rockford, Ill*

MORE DATA, Circle 114, inside back cover

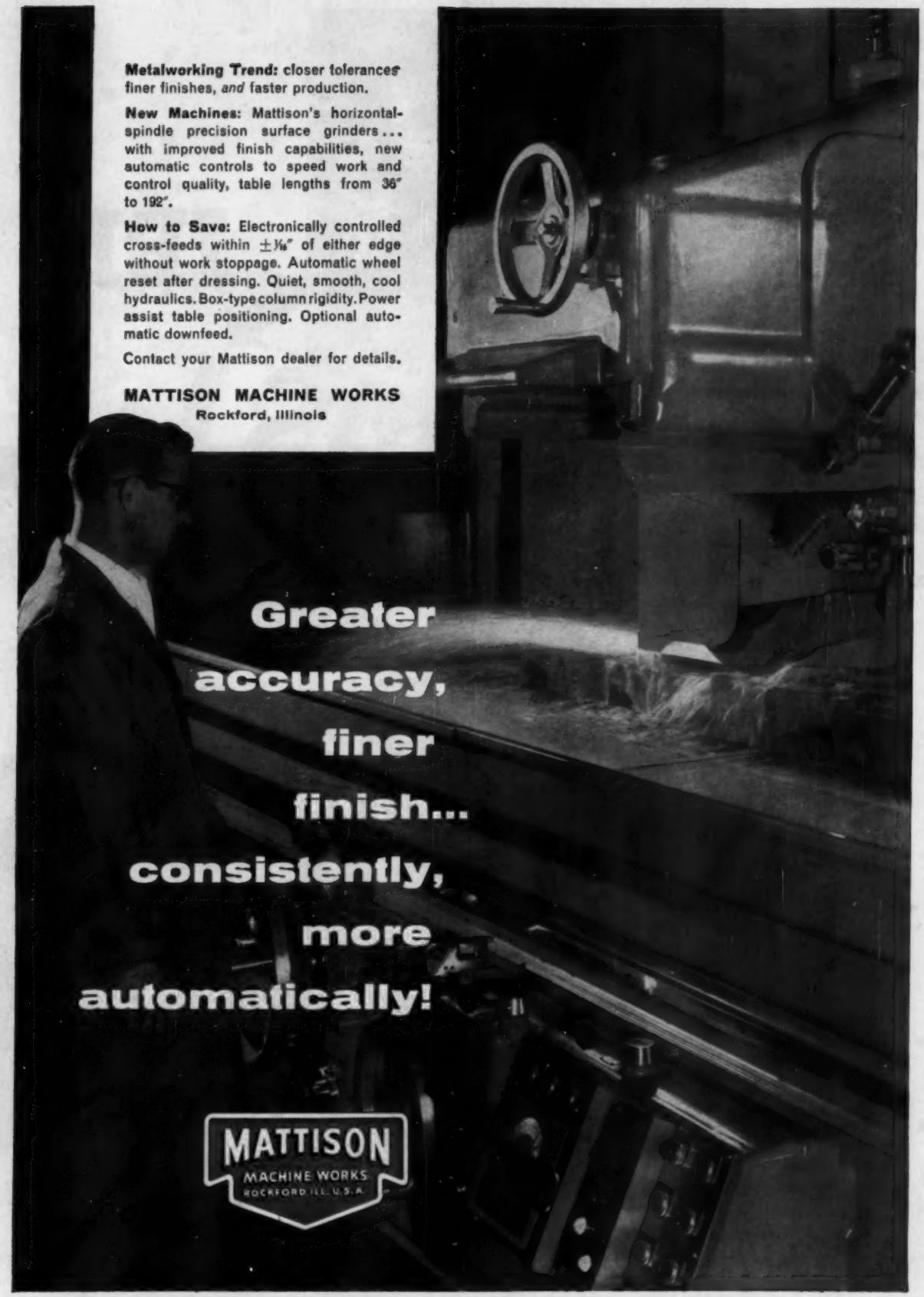
Metalworking Trend: closer tolerances, finer finishes, *and* faster production.

New Machines: Mattison's horizontal-spindle precision surface grinders... with improved finish capabilities, new automatic controls to speed work and control quality, table lengths from 36" to 192".

How to Save: Electronically controlled cross-feeds within ±1/16" of either edge without work stoppage. Automatic wheel reset after dressing. Quiet, smooth, cool hydraulics. Box-type column rigidity. Power assist table positioning. Optional automatic downfeed.

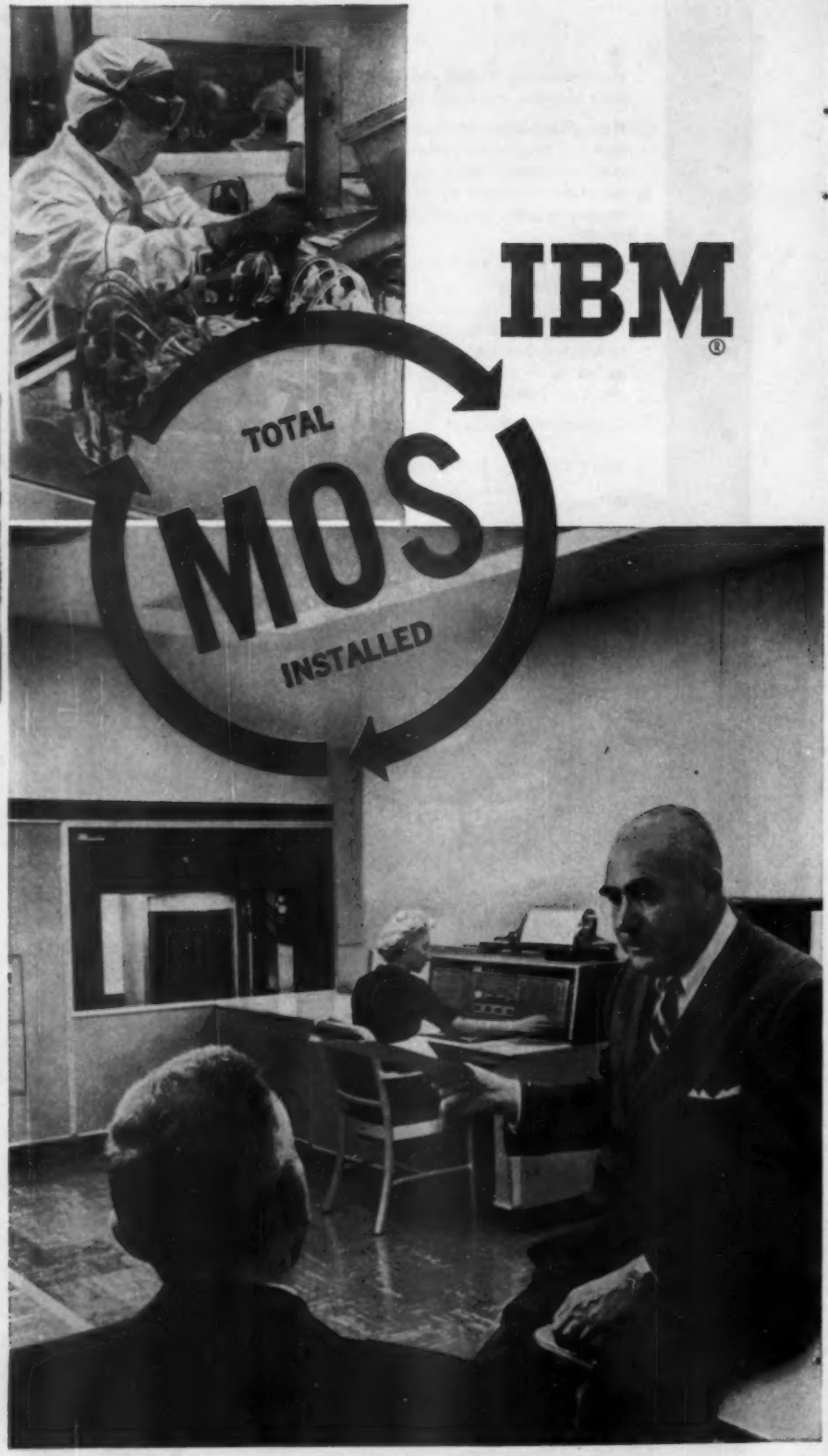
Contact your Mattison dealer for details.

MATTISON MACHINE WORKS
Rockford, Illinois



No personnel shortages–MOS lets management know on a periodic basis what the future requirements will be for materials and personnel.

No product shortages–Periodic reports from RAMAC guarantees that American Cyanamid has adequate inventories at all times.



No delays in getting the facts–Mr. Henry Wendt, Jr., General Manager of American Cyanamid's Surgical Products Division, gets up-to-the-minute information with the help of the IBM RAMAC 305 Data Processing System.

Management Operating System

at American Cyanamid's Surgical Products Division

...*speeds service through automatic inventory control*

The *Surgical Products Division* of American Cyanamid Company handles over 1700 individual items at 43 locations. They now have continuous *automatic* control over manufacturing, inventory, and distribution.

This is accomplished by a new dynamic technique—IBM Management Operating System. Using IBM RAMAC® equipment, MOS coordinates planning and control functions continuously throughout the manufacturing cycle. MOS supplies accurate data in time for effective management decisions.

MOS automatically *inter-relates* the six major manufacturing control functions:

1. Sales Forecasting
2. Materials Planning
3. Inventory Management
4. Plant Scheduling
5. Work Dispatching
6. Operations Evaluation

Previously, updating of all this information had taken weeks. The result was a high back order position coupled with an excessive investment in inventory. It also made it difficult to schedule and operate the plant at the highest economy level.

Today, American Cyanamid's MOS provides current control on all phases of production, distribution and manufacturing. It gives management all the information needed to cut back orders, to reduce inventory investment, and to increase plant efficiency.

MOS offers comprehensive control

Only with the total approach provided by MOS can you get such coordinated effort, such complete information, such tight operational control. Only with MOS can you study *in advance* the effects of the decisions yet to be made.

For more complete information call your local IBM office.

IBM® DATA PROCESSING

NEW *small-press versatility*

NEW *small-press productivity*

NEW HYDROLAIR!

...it's *DOUBLE ACTING!*

Like all other Hydrolairs®, this new 30-ton model is a full oil-hydraulic press without motors or pumps—operates directly from shop air line.

ECONOMICAL
COMPACT
VERSATILE
EASY TO OPERATE AND MAINTAIN
and, it's DOUBLE-ACTING!

Smoother, better performance on drawing and forming; greater productivity on plastics molding; greater versatility for development work and job shops; ideal for small-press users!

Ask your Elmes/King Distributor about the new 30-ton DOUBLE-ACTING Hydrolair — and single-acting Hydrolairs in 50, 75 and 100-ton capacities. Or, wire, write or phone us direct.

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American Steel Foundries, ELMES/KING Division
1161 Tennessee Avenue, Cincinnati 29, Ohio

Glidden Expanding In Metal Powders Field

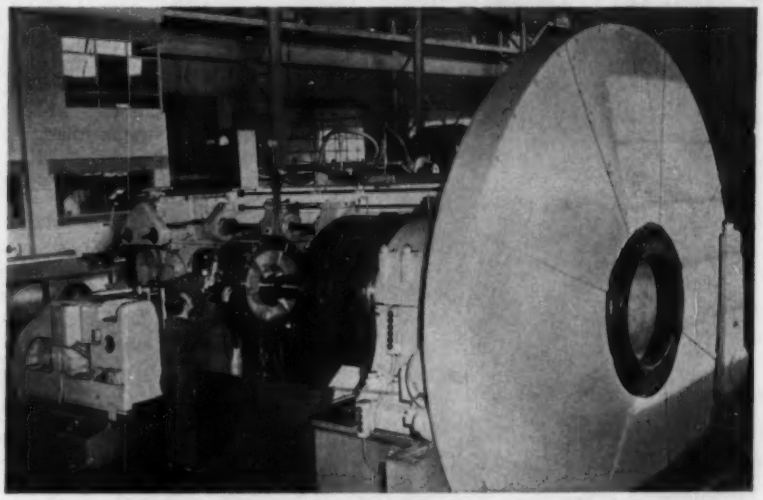
Glidden Co, Cleveland, has acquired the assets of the Metals Division (Johnstown, Pa) of Crane Co, Chicago-based plumbing and electronics firm. The new facilities will become part of the Metals Department of Glidden's Chemical Division. Metals have accounted for about 10% of the company's annual sales of nearly $200 million. The move is aimed at enabling Glidden to enter immediately into the structural ferrous metal powder field. In addition to ferrous products, the Johnstown facilities produce nickel, manganese, silicon, and other special powders.

Pettingell Machine Co Acquired By Electronics Manufacturer

Pettingell, Lakeport, NH, manufacturer of sheet metal working machinery, has been acquired as a subsidiary by Browning Laboratories of Laconia, NH. Pettingell will continue to produce its line of motorized bumping hammers and rotary shears which are presently used by manufacturers in the metalworking, automotive, marine, and aircraft industries. The company will also make all of the metal parts, chassis, and cabinets for Browning, one of the nation's pioneer manufacturers of electronic equipment.

Sylvania Expands at Buffalo For New Contracts

Sylvania Electric Products has leased half an acre of additional floor space for its Great Arrow Ave plant in Buffalo for production of components for the Minuteman ICBM radio-launch control system. Amount of this contract is $7.5 million. The company has also received a $9 million order for the electronic defense system for the B-58 supersonic bomber. Latest order for production of the B-58's passive defense system lifts the backlog for this work here to about $20 million.



Precision gear is cut for propelling machinery of the biggest ship ever built in Australia, a 32,250-ton oil tanker being constructed at Whyalla, South Australia. Since the first ship was built there in 1942, 34 vessels of a total deadweight tonnage of over 260,000 have been launched and there are now five building slips in the Whyalla yard. The town (12,000 population) is set for further development with the scheduled erection of a large-scale steel works

Reynolds Installs Super-Wide Rolling Mills in Ala Plant

Called the widest rolling mills of their kind in the world by Reynolds Metals Co, a 170-in.-wide reversing mill and a 120-in.-wide continuous strip mill have been completed at the company's alloys plant near Sheffield, Alabama. Part of a new "hot line" installation, the 170-in. mill can produce 165-in.-wide plate and the strip mill turns out coils up to 115 in. wide (before trimming) and weighing up to 30,000 lb. The four-stand mill, handling an ingot every two minutes. produces aluminum sheet at better than 1000 ft per minute.

Jack & Heintz, Siegler Merge

Cleveland's Jack & Heintz Inc, manufacturer of military and industrial components, has been merged into Siegler Corp of Los Angeles, producer of military and commercial electronics equipment and components. "No changes are contemplated in Jack & Heintz present management, employees, or facilities," a Siegler spokesman said.

Army Increases Ford Contract

Continued production of the Army's M-151, a ¼-ton utility vehicle, in Detroit has been assured by a $4.5 million award from Army Ordnance District. The contract is in the form

McGIRK'S WORKS
by GEO. CRENSHAW
FRI. P.M.
TAVERN
SAT.
SUN.
WHAT'S WRONG WITH MONK'S ARMS ?
OH, IT ALWAYS TAKES HIS ELBOWS A WHILE AFTER A WEEKEND TO UNBEND!
MOE'S CORNER
Why is it-drinkin' always makes a married man see double an' feel single??

GUARANTEED ACCURATE

The Most for Your "Rockwell Testing" Dollar!

Clark Hardness Testers are *guaranteed* accurate for all "Rockwell Testing". Clark's exacting workmanship in the production of penetrators, testing blocks, anvils, and other accessories pays off in exceptional accuracy on the job. No wonder the low cost surprises our first-time customers. *Clark Instrument, Inc., 10201 Ford Road, Dearborn, Mich.*

FREE REFERENCE BOOK

All information about hardness testing in easy-to-read text with many illustrations. Just write "Send Book" on your letterhead. Description and prices for Clark Hardness Tester and free Hardness Conversion Chart also available on request.

CLARK INSTRUMENT, INC.
10201 FORD ROAD
DEARBORN, MICHIGAN

Missile-Age Accuracy

of a follow-on order to the 4050 vehicles presently under contract. Production of the new order will continue through Oct 1961 at Ford's Livonia Transmission plant and will provide continuing employment for 2500 people working in 20 Michigan area plants which supply parts to Ford for the vehicle

Strong to Make Crane Products

Strong, a division of White Sewing Machine Co, Conneaut, Ohio, has purchased manufacturing and sales rights to iron separators, brass expansion joints, and sediment separators—all proprietary products of Crane Co, Chicago plumbing equipment manufacturer. Strong will make these products available through its own 250 industrial distributors, and through Canadian Fairbanks Morse and American Export Co.

GM's Chevrolet Div in Calif To Produce Corvairs Only

General Motors' Chevrolet Division's assembly plant in Oakland, Calif, has been converted to Corvair production exclusively. It had been previously announced that the change would take place upon completion of the proposed Fremont plant. Change has been effected now because Corvair accounts for approximately 30% of west coast sales, against 15% nationally. On Jan 5 the 44 millionth car of the Chevvy division rolled off the Oakland assembly line. The plant has produced almost 3 million of this total.

Producto's New Facilities

New manufacturing facilities for special die sets are now in operation in Chicago. The new plant, operated in conjunction with Producto Machine Co's Chicago distributor, Federal-Bryant Machinery Co, will provide fast service in special die sets to the North Central, Southwest Central, and Rocky Mountain areas.

Bliss Awarded $5 Million Contract

E W Bliss Co, Canton, Ohio, has just been awarded a $5-million contract by the Air Force for production of 110 emergency overrun barriers (safety stops to keep jets from overshooting airfields). Bliss will not only manufacture, but install the barriers at Air Force bases throughout the world.

Ford Orders New Equipment For Aluminum Casting Plant

Ford Motor Co's Sheffield, Ala, aluminum casting plant has ordered equipment which reportedly will have a marked effect on its automotive parts production. It is purchasing three 1200-ton die casting machines, a holding furnace of 3500-lb capacity, and a 25-ton die for each new machine. Largest die casting machines currently used at Sheffield are classified at 1000 tons.

Form Wheelabrator of Canada

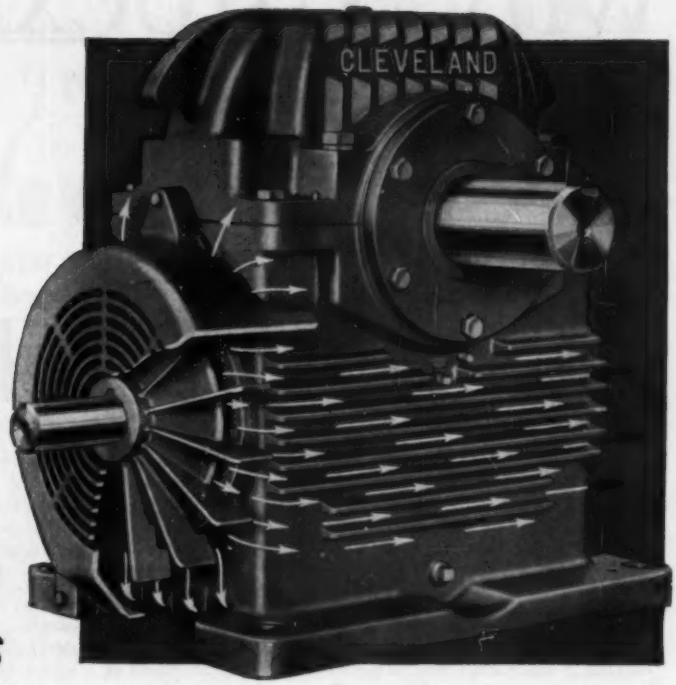
Wheelabrator of Canada Ltd has just been formed by Wheelabrator Corp, Mishawaka, Ind, as successor to the company's Canadian Division. Named president of the blast cleaning and dust collection equipment manufacturing and sales organization is Harold M Miller. Other officers are: J D Lamb, sales manager; Jacob A Schmidt, Jr, vice president; Edward T Sullivan, secretary and treasurer, and James E Donlan, controller.

Alcoa Completing Expansion At Davenport Works

Aluminum Co of America's $1.5 million expansion is nearing completion at its Davenport, Iowa, works. Program will establish the company as a major source of unprinted aluminum foil laminations for packaging, labeling, building insulation, and other industries. New foil laminators and supporting equipment, now approaching full operating condition at the facility, will enable Alcoa to produce unprinted foil in combinations with paper, wax, paperboard, and plastic materials for printers, package makers and users, and converters

(Continued on p185)

"May I?"



Fan cooling for Increased HP Capacity is Not New... *to users of Cleveland Speed Reducers*

As far back as 1944, Cleveland Speedaire Worm Gear Reducers (shown in both the announcement ad and cutaway photo below) were providing industry twice the load carrying capacity then available from standard worm gear units of equal frame size. Even then, it was *fan cooling* that did the trick—because fan cooling was and still is the most practical method of heat dissipation.

On the new, higher horsepower Cleveland's (shown in top cutaway photo), a small, specially designed fan—equally effective in either direction of rotation—is located on the worm shaft's input side. Fan size and design permit a smooth, more effective flow of air beneath, above, and around all sides of the reducer.

Mounting the cooling fan on the WORM shaft input end is a very definite Cleveland advantage for when the fan is mounted on the *opposite* side, a second oil seal is needed. This results in additional friction loss due to seal drag—and is another point where oil leakage could occur.

Remember, it was Cleveland design engineers who pioneered both fan cooling and centrifugal casting of bronze gears—and after sixteen years of rugged field usage in all types of industrial plants, have now incorporated these features in all units (from 3 to 12-inch centers) of the new standard Cleveland Speed Reducer line.

Get the story of these new speed reducers from your Cleveland representative, or write today for free 36-page illustrated Bulletin No. 410 that contains complete engineering information. Either way, you will get the answer to improved speed transmission—at savings of 50% or more on per horsepower cost!

A 1944 CLEVELAND AD
"Announcing A Fan-Cooled Worm Gear Speed Reducer ... SPEEDAIRE."

CLEVELAND
Worm Gear
Speed Reducers

Cleveland Worm & Gear Division
Eaton Manufacturing Company
3254 East 80th Street • Cleveland 4, Ohio

why Ampex uses NIKON OPTICAL COMPARATORS

The new Ampex AR-300, developed principally for military and scientific applications, is the only recorder capable of covering a 4-megacycle bandwidth. It can capture and record phenomena beyond the range of any equipment in use today.

The most vital component in the AR-300 is its rotating recording head, designed to achieve the high, head-to-tape velocity required for wide band response, yet maintaining a relatively low, reel-to-reel speed.

Nothing in the manufacture of the AR-300 proved as critical as the production of this head. Most of its parts did not lend themselves to conventional inspection methods. While .0001" tolerances had to be maintained, Ampex standards call for inspection equipment capable of at least 10 times the required accuracy.

This inspection problem was finally solved when the task was assigned to a Nikon 6 Optical Comparator. Not only did the Nikon Comparator provide the exact measurements required during 'in-process' inspection, but it also permitted consistent duplication of these measurements, time after time.

Today, the Nikon 6 has a permanent position on the AR-300 production team. Furthermore, there are now five additional Nikon comparators serving Ampex in other production projects, and in development—helping to maintain the high quality standards for which Ampex products are justly famous.

Why not investigate what a Nikon comparator can do for you?
Write for complete, illustrated catalog to Dept. AM-2

NIKON INCORPORATED, 111 FIFTH AVE., NEW YORK 3, N. Y.

Canadian GE Gets US Order

Approximately $1 million worth of specially designed electronic equipment will be manufactured by Canadian General Electric Co Ltd of Toronto as part of an air defense search radar contract awarded by the US Air Force to the General Electric Co (US). Under a subcontract from the US firm, CGE will sublet parts of the order to Canadian component manufacturers.

Raytheon Acquires Trans-Sil

Raytheon Co, Waltham, Mass, has acquired the stock of Trans-Sil Corp, Englewood, NJ, makers of rectifiers for the electronics and electrical industries. Trans-Sil will operate in conjunction with Raytheon's Machlett Laboratories in Springdale, Conn. Trans-Sil will retain its present staff of 50.

Combustion Engineering to Build Biggest Boilers Ever Designed

Combustion Engineering Inc has submitted to TVA the apparent low base bid for building two of largest steam boilers on record. CE's bid was $33 million as against Babcock & Wilcox's $33.6 million. First of the steam generators must be ready to operate in a planned TVA power plant (site not yet selected) by Sept 1964 and the second must be completed a year later. Height of the huge units will be equal to a 22-story building. Each will produce steam sufficient to operate a turbo-

"I'd better hang up now, honey. The boss is very strict about personal calls."

THE INSIDE STORY BEHIND THE "NECKING" OF THE NEW

JARVIS STUBBY

NEW STUB SCREW MACHINE TAPS FOR BAR AUTOMATICS SAVE TIME, ELIMINATE ALTERATIONS!

HIGH SPEED STEEL – GROUND THREADS

Three Styles Available

Spiral Flute Bottoming #SF-01 | Spiral Point Plug #SP-50 | Spiral Point Bottoming #SP-70

WHY STUBBY?

Jarvis Stubby, a new screw machine stub tap developed for production tapping on bar automatics, is designed to cut costs by eliminating down time and improving performance.

SECRET OF STUBBY'S "NECKING"

The area directly behind Stubby's threads has been necked down to below the root diameter. This "necking" creates *more chip room . . . reduces drag . . . facilitates application of cutting oils or coolants* to the cutting edges for *longer tap life.*

STUBBY IS STRONGER

Its *short threaded section* and *shorter overall length* make Stubby a much *stronger* tap. You use standard size bushings (eliminating the need for special drills when making tap holders), because Stubby's shank is ground to standard fractional dimensions. Depth of thread is not a problem; for the combination of length of thread and length of necked shank is equal to the thread length on equivalent standard taps.

STUBBY BEATS COSTS – CUTS DOWN TIME

With Stubby you no longer need to alter standard taps for short clearance jobs. This means you cut costly machine down time, operator's time and minimize the possibility of having inconsistent tap performance.

STUBBY AVAILABLE FROM STOCK!

Stubby *is available from stock* in Spiral Flute Bottoming #SF-01, Spiral Point Plug #SP-50, and Bottoming Spiral Point #SP-70. All 3 styles available in machine screw sizes #2 thru #10. Other sizes available on request. WRITE FOR STUBBY LITERATURE AND TAP CATALOG.

OTHER JARVIS TAPS AVAILABLE:

- HAND TAPS
- MACHINE SCREW TAPS
- PIPE TAPS
- NUT TAPS
- ALL TYPES OF SPECIALS
- TAPPER TAPS
- PULLEY TAPS

Jarvis CORPORATION
NORTH ATTLEBORO, MASS.

SEND COUPON FOR PROMPT DETAILS

Jarvis Corporation
104 Washington Park
North Attleboro, Mass.

☐ Send Rep. ☐ Send Stubby lit.
☐ Send Tap cat.

Name Title
Company
Street
City State

ONE MADISON RECESSING TOOL DOES THE WORK OF TWO...WITH SNAP-ON ADAPTOR!

New, snap-on work pilot adaptor converts the tool for piloting either in the work piece or in a fixture, enabling you to use the tool in any standard shop equipment. For even greater versatility, a replaceable nose piece permits the rapid changeover, when piloting in the work, from one piece part to another of different I.D. dimensions.

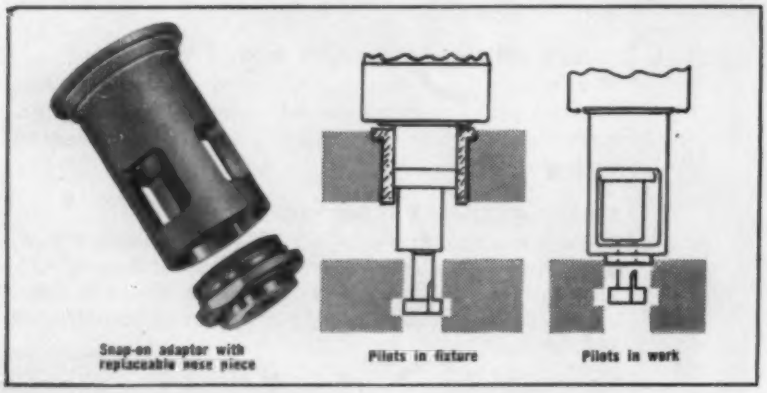
CUTS TO EXACT DEPTH, WIDTH AND POSITION . . . WITHOUT "CHATTER"

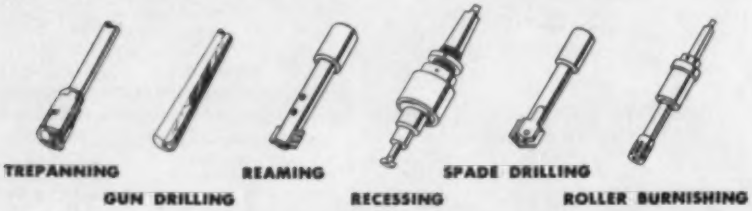
Because of a solid, single bar construction having a long bearing surface with only one joint, the Madison Automatic Recessing Tool eliminates deflection and run out. It cuts accurately to depth, width and position . . . in one operation.

A precision-machined feed cam and heavy duty feed pin assure uniform feed out of the cutter.

Through two calibrated adjustment nuts, you quickly and easily set the tool to exact specifications.

With less time needed for set up, and with a fraction of the production time usually required, the recessing tool can pay for itself in runs of 100 parts or less.





MADISON *Industries, Inc.*

P. O. BOX 1137, PROVIDENCE, RHODE ISLAND

generator of 1,072,800 hp, believed to be the greatest amount of electric energy ever turned out by a single piece of machinery.

Traub Machines in USA

Hermann Traub Machine Works of Reichenback/Fils (West Germany) and Dielsdorf, Switzerland, has formed Traub USA located in Long Island City, NY, for the distribution and servicing of the manufacturer's 1-spindle bar and chucking automatics. All spare parts are carried in stock for immediate shipment, and a service department with complete facilities for cam making and tooling has been set up.

New Plant for Mississippi

Universal Manufacturing Corp, Paterson, NJ, manufacturer of electrical components, plans to build a $1,750,000 plant midway between Mendenhall and Magee, Mississippi, in the near future. With this move, Universal Manufacturing is expected to become the largest employer to come into the state in five years. Initial employment is expected to be 350, with an ultimate payroll of 1200.

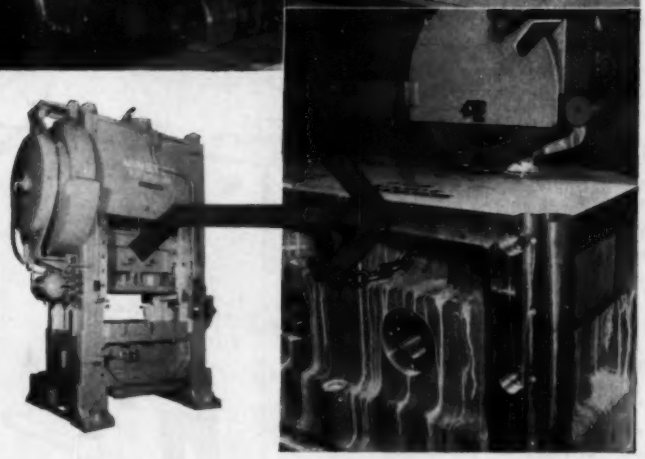
SKF to Build Research Lab

SKF Industries, Philadelphia, is looking for a site in Radnor Township, Pa, on which to locate a multimillion dollar research laboratory. The ball and roller bearing manufacturer is planning to put up a $2.5 million research building on about 25 acres of the Chew estate tract. Structure, to contain about 80,000

". . . And another thing, you're not supposed to make me work—you're supposed to make me want to work."

SIZE FOR SIZE

there are no heavier or more accurate surface grinders made than these fast, heavy duty Thompsons



Thompson Type CX heavy-duty surface grinders are designed to grind heavy, massive work pieces. Their stock removal rate is very fast while maintaining extremely close limits of accuracy and microfinish.

Shown here is a Thompson Type CX 30x36x96 machine recently installed in the Minster Machine Company plant at Minster, Ohio. It is grinding the face of the slide for a 200-ton capacity Minster Piece-Maker High Speed Automatic Production press.

The slide is cast iron and weighs approximately 7000 pounds. It is being ground for precise parallelism and to a 20 to 30 RMS finish.

Thompson Grinders have an important part in the production of these world-famous Minster presses. The dependability of Thompson Service and the excellent performance of the Thompson machines now in use at Minster were major factors in the purchase of this latest grinder.

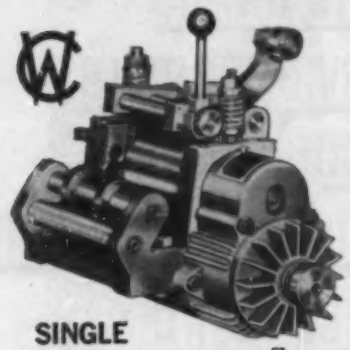
If your production involves the grinding of large, heavy work, it will pay you well to investigate the money and timesaving features of these modern machines.

THE THOMPSON GRINDER CO. Springfield, Ohio

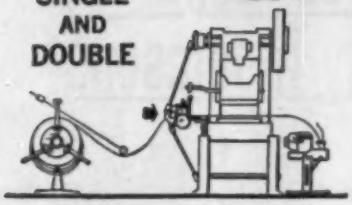
SURFACE GRINDERS

"Keep Thompson in mind for that daily grind"

COOPER WEYMOUTH



SINGLE AND DOUBLE



roll feeds

FOR STAMPING PRESS HIGH SPEED AUTOMATIC OPERATION

Cooper Weymouth single and double Roll Feeds can increase stamping press production. Automatically feed coil stock to press.

These roll feeds push or pull stock to stamping presses at speeds up to 450 strokes per minute. The feeding is accurate and controlled, with but one simple adjustment to change feed lengths. Equipped with a trouble-free high torque carbide clutch and disc type air cooled brake with twice the usual braking area. Fifteen standard sizes, with feed length and stock width capacities up to 12".

Increase Production, Lower Costs — Use These Cooper Weymouth Products

Stock Reels, Stock Straighteners, Small Part Straighteners, Mechanical and Air Operated Slide Feeds, Scrap Choppers, Coil Cradle Combinations.

COOPER WEYMOUTH, INC.
602 HONEYSPOT ROAD
STRATFORD, CONN.

sq ft, will house some 250 scientific and technical employees.

The company has also acquired a newly completed plant in Asheville, NC, under a long term lease, for increased production and sale of the Expediter railroad bearing. The facility may ultimately provide employment for about 400 workers in the area.

Alcoa Closes Down Two Potlines

Aluminum Co of America has closed down two potlines at its smelting plant in Badin, NC. Cutback, which has idled 160 workers, has been made necessary by inventories in excess of current demands for aluminum. Employment at the plant has been approximately 600 for the past several years. Although the current inventory situation has also resulted in the temporary shelving of a planned multi-million dollar modernization program at the plant, work is expected to proceed on schedule on the $17 million Tuckertown power project some 15 miles up the Yadkin River from Badin. This project is due for completion next year.

Neptune Contracts to Lockheed

Lockheed Aircraft's California Division, Burbank, has been awarded a $4,941,573 Navy contract for manufacture of electronic equipment for 69 P2V Neptunes (antisubmarines aircraft), continuing a 1958-instigated program for modifying Neptunes already in service. Lockheed has enough Neptune business scheduled to carry manufacture through April, 1962, including modifications, which will phase out this September.

Navy Hires 500 at Shipyard

The Hunters Point Naval Shipyard at San Francisco is hiring 500 additional mechanics because of work being done to convert the heavy cruiser USS Chicago to a missile carrying vessel.

Allis-Chalmers Gets Contract for Plasma Jet Test Stand Facility

North American Aviation has awarded a contract to Allis-Chalmers for design and construction of a 1-mw plasma jet test stand facility to be located at NA's Los Angeles Division plant in El Segundo, Calif. As prime contractor, A-C assumes complete responsibility for the plasma generator, expansion nozzles, test section, power supply control and instrumentation. Plasma stream will be directed through a test chamber in which exotic material will be tested for thermal shock resistance and aerodynamic reactions.

Diesel Tractors for India

Canada's Massey-Ferguson Ltd, Toronto, will shortly go into manufacture of diesel tractors at Madras, India. The new plant will employ 3000 workers on a single-shift basis, and is expected to turn out 3500 tractors a year. After the first two or three years, parts and materials are expected to be supplied almost entirely from Indian sources. Tractor manufacture will gradually be extended to include agricultural implements.

Bliss Gets Big Press Order

Nine large metalworking presses totaling over 1.25 million in price have been ordered from the E W Bliss Co's Press Division at Hastings, Mich, by a major automotive manufacturer. The order includes presses of two-point and four-point slide suspension and capacities of 600 and 800 tons; they'll be built at the Salem, Ohio, plant.

S-P of Canada Expands

Studebaker-Packard of Canada has just bought additional property for expansion of its Hamilton, Ont, plant. The new space will free a large area within the present plant, allowing straightening of assembly lines, and will provide additional storage for materials. Output will be upped "moderately" as a result of the expansion.

"I took my wife out again last night, but she found her way back."

REMEMBER?

'Twas a time when the cigar store Indian was a red-hot salesman. Years ago, true, but don't underestimate his selling power. He was good.

Today's parallel is the popular mechanical vending machine, used in selling so many items. As with any salesman, the more economical his cost, the greater the profits. To manufacturers of vending machines Wiedemann Turret Punch Presses offer a way to cut piercing costs 60% to 90%.

One manufacturer of vending machines placed his product on the market in April instead of a contemplated September date, at phenomenal savings in permanent tooling. The "Wiedemann Method" eliminated their usual problems in modifying hard tooling to keep up with the engineering changes.

Metal fabricators of components for similar equipment in every industry can realize the same savings. For, wherever there is need for accurate locating and producing openings in sheet metal, plates and many laminated materials, to customers' designs, the "Wiedemann Method" sets a new standard for short run piercing.

Time studies of your work will show you how a Wiedemann Turret Punch Press will materially cut your piercing costs and increase your production efficiency.

From the versatile 150 ton R-15 down to the hand operated R-2, there's a Wiedemann for your short run piercing requirements.

WIEDEMANN

WIEDEMANN MACHINE COMPANY

Dept. AM-2A Gulph Road • King of Prussia, Pa.

EVALUATE MAR PENETRATION WHERE IT COUN

AND

YOU'LL

DECIDE THIS

METALWORKIN MOST POWERF SELLING TOOL

KET

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IS

G'S

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In metalworking—men who matter read...

American Machinist / ***Metalworking Manufacturing***

A McGraw-Hill Publication, 330 West 42nd Street, New York 36, N. Y.

There are 21 basic manufacturing industries in the U.S. Government's Standard Industrial Classifications. Eight of them make up metalworking—the manufacturing of products from metal—and American Machinist/Metalworking Manufacturing concentrates its circulation (all ABC paid, incidentally) in these eight. An executive responsible for mining, ore-producing, or refining operations—or in any industry not involving metal*working*—is almost automatically excluded as a potential reader by his lack of vital interest in the subjects covered editorially by AM/MM.

AM/MM's circulation is centered in key metalworking plants in key metalworking states and is growing steadily in all eight divisions of metalworking.

Because AM/MM is read by men—manufacturing managers, manufacturing engineers and plant managers—whose sole business is making things of metal (and making them more efficiently, less expensively, more profitably), we think you'll agree it is metalworking's most powerful selling tool.

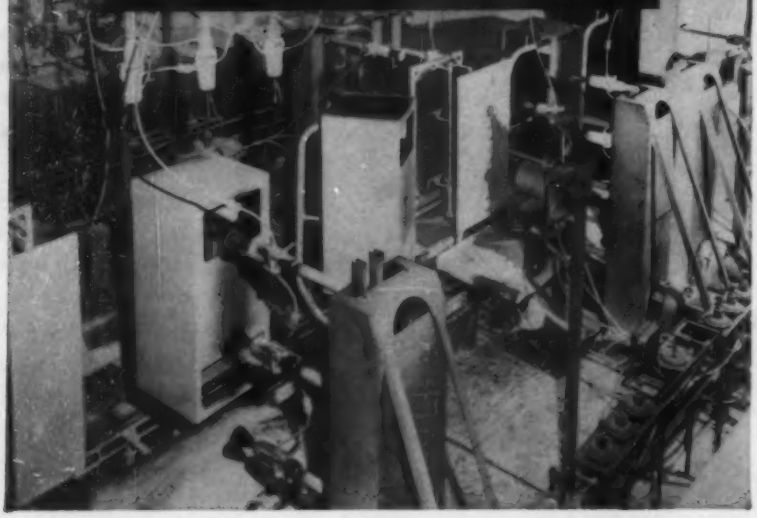
For up-to-date facts and figures on metalworking, ask your AM/MM *district manager for a copy of the 1960 Market Guide for Sales Executives.*

NEW

RANSBURG

MOVING BELLS

increase paint mileage
...improve quality on
KELVINATOR REFRIGERATORS



Ransburg's No. 2 Process moving bells—latest innovation in electrostatic painting—automatically paint mixed sizes of refrigerator cabinets and doors on Kelvinator's new finishing line.

On this job—first of its kind—limit switches re-position the reciprocating bells to accommodate various model sizes mixed on the same line. And, electric eyes selectively trigger the paint on and off between parts.

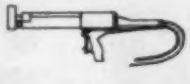
RESULTS? Automatic electrostatic spray painting—which replaced a battery of reciprocating automatic air guns—is providing Kelvinator with a beautiful, higher quality, and more uniform finish. Rejects, formerly a troublesome problem, have been practically eliminated. And, along with appreciable labor savings in this highly automated set-up, paint mileage is substantially improved . . . even bettering the savings indicated in pre-installation lab tests at Ransburg.

Like Kelvinator, other manufacturers of quality products will find Ransburg's moving bells the automation answer for production lines where batching of similar parts is impractical.

NO REASON WHY YOU CAN'T DO IT, TOO!

Want to know how Ransburg No. 2 Process can improve the quality of YOUR painted products—and at the same time—cut YOUR paint and labor costs? Write for our No. 2 Process brochure. Or, if your production doesn't justify automatic painting, let us tell you about the No. 2 Process Electrostatic Hand Gun which can be used in either conveyorized, or non-conveyorized painting.

RANSBURG



RANSBURG Electro-Coating Corp.

Box 23122, Indianapolis 23, Indiana

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 HORIZONTAL BORING MACHINES—*Bullard Co, 286 Canfield Ave, Bridgeport 9, Conn.* 19-page catalog gives detailed data on the Dynamill with capacities of 3, 4 and 5 in. (28 spindle speeds) with speed ranges respectively of 12 to 1800; 8.5 to 1200; and 7 to 1000; infinite number of feeds ranging from 0 to 0.125 ipr. Features include power drawbar that permits quick and accurate tool change without necessity of drive keys and drifts; fully automatic hydraulic binders for head, table, and saddle; clock-type dials for precise location of head, table, saddle, and spindle; remote control pendant; saddle stops, feed bracket; Depth-Au-Trol that stops the spindle feed or traverse at predetermined positions automatically; and numerical control for positioning the head and table.

2 VERTICAL TURNER—*Motch & Merryweather Machinery Co, 1250 E 222nd St, Cleveland 17, Ohio.* 12-page catalog VT-123 illustrates and describes units which can be assembled by building blocks to meet specific requirements. Bases, columns, slides, spindles, and tools may be arranged to create an infinite variety of turners with manual, semi-automatic, or completely automatic cycles available on all machines. Detailed specifications provided.

3 SINGLE SPINDLE AUTOMATIC—*Cleveland Automatic Machine Co, 4933 Beech St, Cincinnati 12, Ohio.* 4-page bulletin provides information on new design of the 2½-in. Model AW. This bar automatic has variable forward and return turret feeds controlled through an improved, simplified mechanical drive using a separate feed motor and an automatic, air-operated disc-type friction feed clutch. Forty spindle speeds ranging from 60 to 1920 rpm are available with four automatic changes, both forward and reverse, for each set of change gears.

4 CLEEREMAN LAYOUT DRILLING MACHINE—*Jackson-Fotsch Co, 7350 W Lawrence Ave, Chicago 31, Ill.* 12-page catalog 160 illustrates and describes machine designed to meet requirements where the ultra-precision of the Cleereman jig borer is unnecessary. Successive operations involving drilling, boring, reaming, tap-

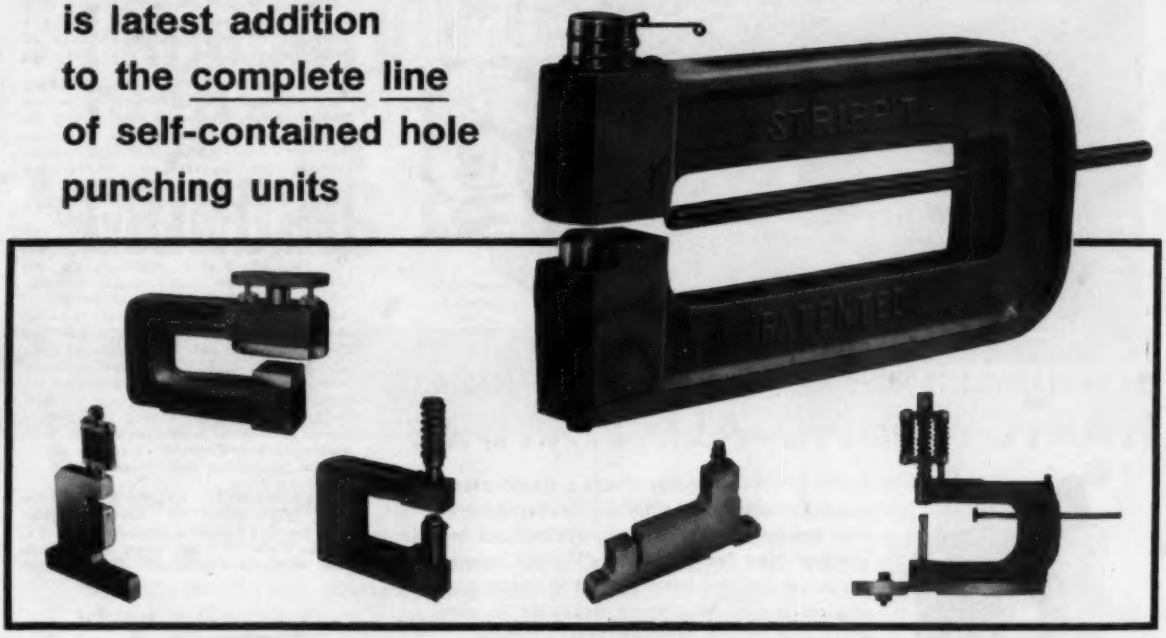
"Forbes, don't you think you're carrying this 'relax to create' approach a little too far?"

Wales STRIPPIT's new "BN" units have been designed for use *with or without* a guide button. Now, with this exclusive feature, only a punch and die (round or shaped) are required when you change from one hole size to another. For special applications and for optimum hole quality, the option of using a fitted or closed guide is still available.

THE GUIDE BUTTON GOES OUT THE WINDOW

NEW STRIPPIT "BN" SERIES

is latest addition to the complete line of self-contained hole punching units



Only STRIPPIT's "BN" units offer all these features:

- Use of fitted or closed guide button optional.
- All holders keyed for *both* round or shaped punches and dies.
- Self-storing keys supplied with each holder.
- Streamlined holder permits punching closer to leg of formed flanges and angles.
- New die section design permits easy removal and rotation of die without removing holder from set-up and retains the advantages and strength of one-piece construction.
- New threaded gage rod positions work more accurately and positively.
- All units, including ¾" unit, have hold-down slots for easier mounting.
- New stripping guide slips out quickly and easily without taking off retainer clip.
- One-piece oil hardened tool steel punches.
- Series expanded to include maximum hole size of 3½" in 10 gauge material.

WALES STRIPPIT INC.

A UNIT OF HOUDAILLE INDUSTRIES, INC.

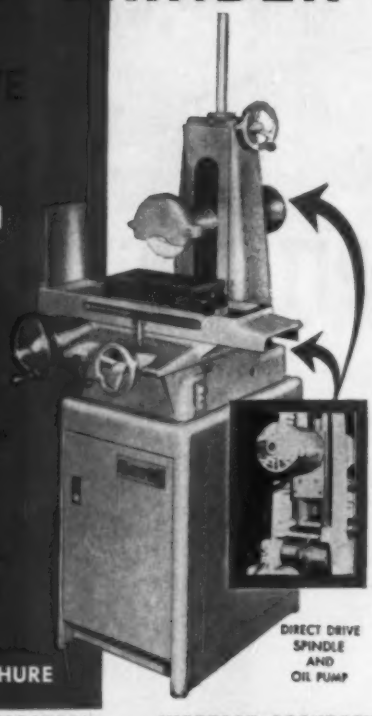
200 Buell Road • Akron, New York

In Canada: Strippit Tool & Machine Company, Brampton, Ontario
In Continental Europe: Raskin S. A., Lausanne, Switzerland *In the British Isles: E. H. Jones (Machine Tools) Ltd., Hove, Sussex, England*

Harig 612 SURFACE GRINDER

with NEW... EXCLUSIVE

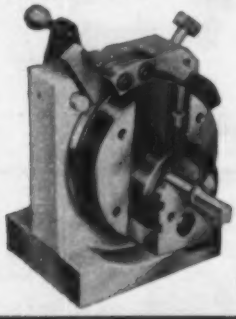
AUTOMATIC FORCED LUBRICATION



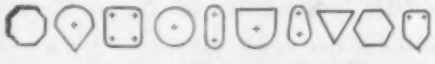
WRITE FOR HARIG 612 BROCHURE

THE FASTEST WAY TO GRIND PERFORATORS . . . INCREASE ACCURACY

HARIG GRIND-ALL FIXTURE



Easily grinds irregular shaped perforators concentric with shank within ± .0001 accuracy. Also can be used for milling, boring, and inspection. New features include V-block adjusting screw and sine arrangement to obtain any desired angle. Attachment available to convert Grind-all into precision Radius Dresser.



WRITE FOR NEW GRIND-ALL BROCHURE

OTHER PRODUCTS OF HARIG MACHINE TOOL DIVISION

VISES

RELIEF-GRINDING FIXTURE

AIR-FLO FIXTURE

WRITE FOR BROCHURES

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ping, are quickly performed at maximum speeds and feeds. Various models offered range from the standard unit with hand traverse to table and saddle, to the automatic positioning type machines.

5 NUMERICALLY CONTROLLED CONTOUR MILLING MACHINES —*Giddings & Lewis Machine Tool Co, Fond du Lac, Wis.* 12-page catalog DM-115 covers die sinking and contour milling machines. Lists operating advantages and costs savings of numerical control and horizontal-spindle design. Illustrates optional equipment and includes basic specifications for 10 and 20-hp machines.

6 WET ABRASIVE CUTTING MACHINE—*Allison-Campbell Division, American Chain & Cable Co, 929 Connecticut Ave, Bridgeport 2, Conn.* Illustrated bulletin DH-63 contains description of Model 412 that cuts most materials from mild steel to such metals as Rene 41, Incoloy 901, Wasaloy, titanium, and Refractaloy. Using a 24-in. dia abrasive cutting wheel, the 412 will cut solids, tubing and structurals at the rate of 7 to 10 sq in. per minute. Hydraulically operated, it has a cutting capacity of 12-in.-dia or square.

7 NUMERICAL CONTROL SYSTEMS —*Bendix Corp, Industrial Controls Section, 21820 Wyoming Ave, Detroit 37, Mich.* 16-page general catalog 308 covers the new DynaPath-20 Series contouring controls, the DynaPoint-20 Series, and Ferranti positioning control systems. The Bendix-distributed Ferranti coordinate measuring machine is also described .

8 MORANDO LATHES AND BORING MILLS—*S & S Machinery Co, 140 53rd St, Brooklyn 32, NY.* 4-page brochure describes the Morando line of heavy-duty lathes giving specifications in all 18 swing sizes that range up to 84 in. Also covers the Morando vertical boring mill and gives specifications of the seven standard models which range to 120 in. A section of the publication deals with the newest Man-Au-Cycle extra-heavy models that feature up to 16-in. hole in spindle, and 6-spindle automatic models capable of automatic six-station machining and threading.

9 ABRASIVE BELT MACHINE—*Carborundum Co, Curtis Machine Division, PO Box 337, Niagara Falls, NY.* 4-page Form CUB 217 gives specifications and discusses advantages of the Curtis

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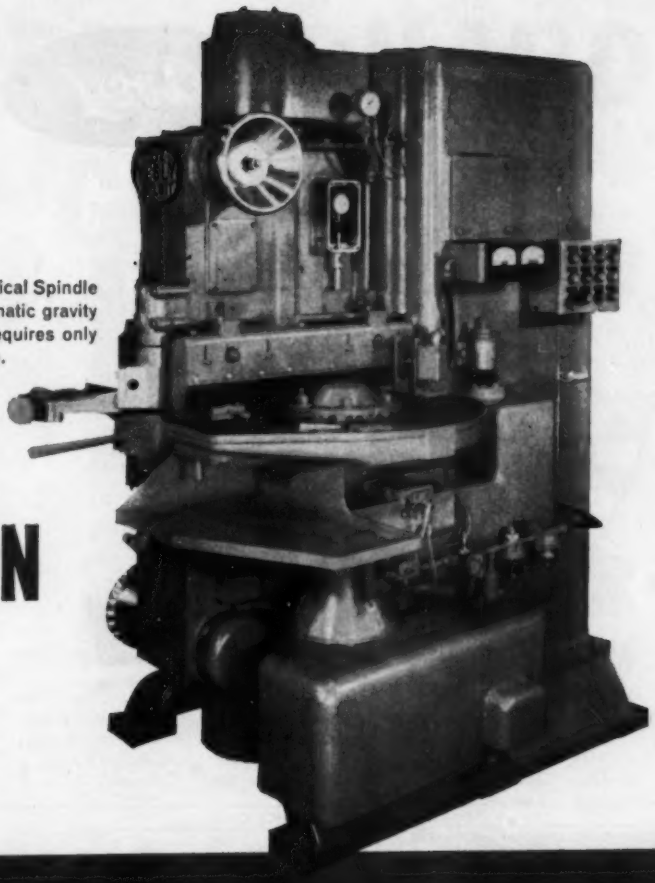

Besly DV2 Double Vertical Spindle Disc Grinder with automatic gravity feed and discharge. Requires only 8-ft. by 8-ft. floor space.

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The Besly DV2, illustrated is representative of the new line of double-vertical spindle disc grinding machines now being manufactured in our South Beloit plant. Designed for production use, this unit is shown grinding top and bottom of $\frac{3}{8}$" thick throw-away carbide inserts at a rate of 3,000 passes an hour. Three passes are required to remove .016" of stock. *Tolerances on the final pass are held within .0003" for flatness, parallelism and size, with a 4 micro-inch finish.*

The DV2 will grind parts that range from .050" to $2\frac{1}{2}$" in thickness and .375" to 3" in diameter. In addition to grinding carbides or hard ceramics that require diamond abrasives, the DV2 also grinds stampings, plastic parts, alnico magnets, bearing races, coil springs, carbon parts and the like with resinoid-bond abrasive discs.

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6 precision spindles by

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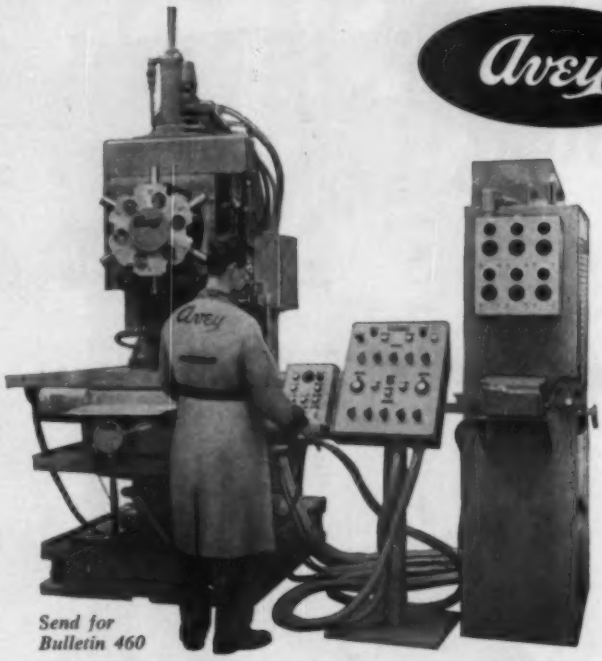

Send for Bulletin 460

You can get this rugged Avey 250 Turret-Dex with either automatic or numerical controls. Rotary, 2- or 3-axis positioning. Pre-selected speeds, feeds, rapid advance, tapping cycles. Automatic depth control all spindles; automatic turret clamp; positive spindle stop; skip index. Capacity to 1¼". Eight spindles optional. Avey, Box 1264, Cincinnati 1, Ohio.

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The WINSLO-MATIC Drill Pointer is completely automatic and extremely fast. Produces helical, split-point, sheet metal, conventional points, etc. Due to the ultra-precision point, you get extremely true, close-tolerance holes, even in the new "exotic" alloys.

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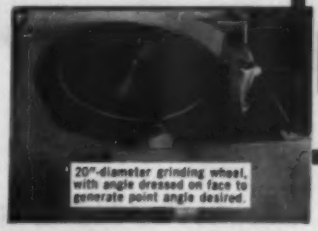
- Drills last up to twice as long.



20°-diameter grinding wheel, with angle dressed on face to generate point angle desired.

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150 Series which handle workpieces 1/20 to 3 in. thick to 49 in. wide. Infeeds are up to 100 linear feet per minute.

10 MILLING MACHINES AND ACCESSORIES—*Barker Engineering Co, 26470 Lakeland Blvd, Cleveland 32, Ohio.* 6-page bulletin provides information on four bench-type models with 3-way feed travel by hand levers, micrometer feed screws or air-hydraulic feed. Applications illustrated, specifications detailed.

11 STRAIGHT-LINE INDEXING MACHINE CHASSIS—*Swanson-Erie Corp, 314 E Eighth St, Erie, Pa.* 8-page brochure describes the operating features of the Auto-Tran, designed to accomodate a variety of sequential automatic processing and assembly operations. It features a self-contained drive unit for continuous or intermittent work transfer and a rigid base for mounting operational tooling. The chassis is versatile enough to be used as a basis for a completely automatic machine or for any combination of manual or semi-automatic operations. It is available in a number of standard lengths and index strokes. Specifications, dimensions, indexing and cycling data provided.

12 AUTOMATIC-FEED KEYSEATER—*Star Cutter Co, Box 376, 34500 Grand River Ave, Farmington, Mich.* 4-page bulletin SC-153 contains data on new Model 25. Describes operating and design features of the unit which produces precision keyways up to 2-½ in. wide and 22 in. long. Designed for toolrooms, and low and medium-rate production parts. Tooling and accessories illustrated; table lists a line of standard stocked keyseater cutters from ⅛ to 3½ in. wide that fit the machine.

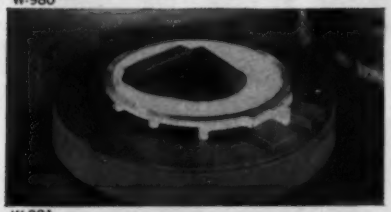
13 AUTOMATIC SCREW MACHINES—*Brown & Sharpe Mfg Co, Providence 1, RI.* 8-page brochure SM44 gives a detailed comparison between new design B&S machines and units of older design. Compares capacities and other specifications, enabling an owner to make his own comparisons with charts.

14 ABRASIVE HARD GEAR FINISHERS—*Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich.* 6-page bulletin 999-60 covers the improved Model 999 and illustrates how they are used for

"It's just a little something I rigged up to keep the oil temperature for me."

W-983

W-980



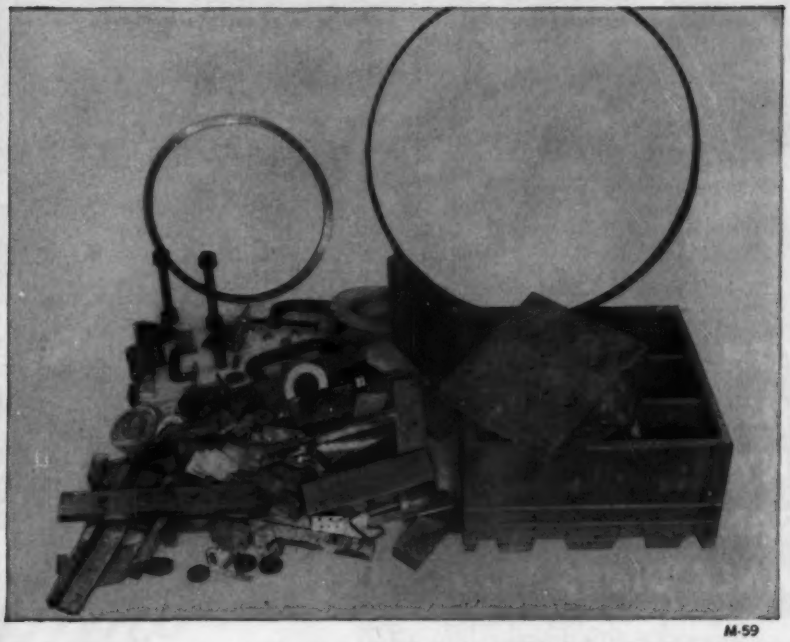
W-981

W-734

W-996

W-998

BLANCHARD GRINDERS



M-59

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Normally, the Blanchard magnetic chuck will hold ferrous work pieces during the grinding cycle.

But when fixtures *are* needed — for holding irregular-shaped objects, whether ferrous or non-ferrous — you can usually select your "fixtures" from the nearest scrap pile.

For high-speed production, close-tolerance finishes and the most versatile grinding capabilities in existence . . . *put it on the Blanchard!*

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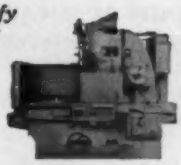
For Best Results, Always Specify Blanchard Grinding Wheels for Blanchard Grinders.



No. 18

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

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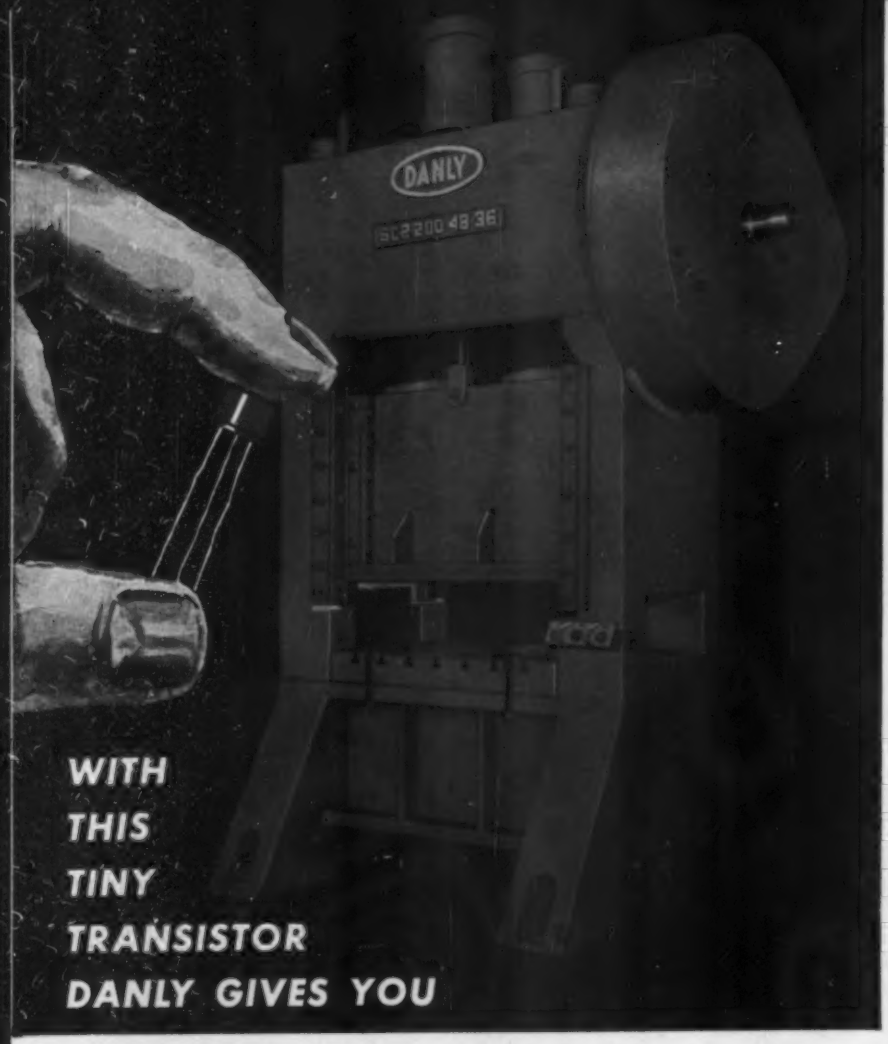

AUTOMATIC SLIDE POSITION TO ± .005!

The operator sets a dial for proper shutheight. **Danly's Positioning Control** automatically adjusts the slide within .005" of the precise height desired! And with repeatable accuracy of ±.002!

This transistorized time-saver is typical of Danly developments in electronic controls . . . imaginative engineering to further improve the performance of any Danly Press. Other Danly controls include: **Danly Speed Control** for constant speed with varying loads; **Danly Proximity Control** to provide accurate switching without physical contact; **Danly Load Indicator** for direct readings of load; **Danly Motion Detector** to monitor speed of shaft, slide or table.

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final surface conditioning of gear teeth after hardening. Discusses various uses, how to produce crowns and tapers, cutting fluids, new resins for hones, automatic and manual home dressing, and automatic loading and unloading.

TOOLS AND ACCESSORIES

● TOOLS—*Carr Tool Co, 3810 Hirds Lane, Cincinnati 12, Ohio.* 16-page illustrated catalog covers line of carbide-tipped expansion reamers, solid reamers, end mills, spotfacers, and counterbores furnished from stock, and special carbide-tipped tools made to specification. Request direct on company letterhead.

15 OILS—*Sun Oil Co, Industrial Products Dept, 1608 Walnut St, Philadelphia 3, Pa.* Technical bulletin 66 gives data and recommended use for eleven straight distilled Circo oils with viscosities from 55 SUS at 100 F to 140 SUS at 210 F. These oils are recommended for hydraulic and circulating systems operating below 120 F, where oil is constantly being replaced because of leakage, or where Fuller's earth filters are used to remove contamination and recondition the oils for extended use.

16 TAP SELECTOR—*Hanson-Whitney Co, 149 Bartholomew Ave, Hartford, Conn.* 36-page revised publication lists by catalog number more than 1200 different sizes and types of standard taps available from stock. Recommendations are made to solve practically any tapping problem regardless of material, type of hole, or class of fit. Includes a list of 66 commonly tapped materials and recommends the best combination of tap, lubricant, and tapping speed for each.

17 ARBORS AND ACCESSORIES — *Cincinnati Milling Machine Co, Cincinnati 9, Ohio.* 20-page catalog M-2029 illustrates and describes a complete line of arbors for milling machines having National Standard spindle nose. Provides details, in addition, on arbor adapters and collars, bushings, and collets.

18 BORING CUTTERS—*Valenite Metals, Box 295, Royal Oak, Mich.* 24-page catalog provides data on Kamset multi-point cutters which employ throw-away inserts to develop fine finishes and

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CHICAGO-LATROBE PRODUCES A COMPLETE LINE OF DRILLS, REAMERS, END MILLS, COUNTERSINKS, COUNTERBORES, CARBIDE TIPPED TOOLS, GUN DRILLS, AND THE EXCLUSIVE C-L "LO-TORK" CHIP BREAKER DRILLS. FOR EXPERT ADVICE AND FINEST SERVICE CALL YOUR CHICAGO-LATROBE DISTRIBUTOR.

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Clip and File

DRILLING TIPS YOU CAN USE

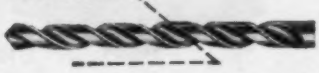
Select the Correct Helix

The spiral flutes of a twist drill perform three functions. They bring the chips out of the hole; provides the proper rake angle at the cutting lip; permit coolants to reach the point of the drill. These actions are vital. All are affected by the helix (the angle of spiral) of the flutes. Be certain that the helix you choose is the correct one for the material being drilled.

Regular Helix

This is the familiar style and the best helix for most general purpose shop work in steel, forgings, castings, and other ferrous materials. Where extra rigidity is required—as in portable drilling—select a regular helix drill with heavy duty construction.

Fast Helix



In general the fast helix is selected for drilling materials of low tensile strength like aluminum, magnesium, copper, and thermoplastics. These materials produce a large volume of chips and the low angle of incline of the flutes is specially suitable for their removal. Where chip removal is slowing drilling, the fast helix may solve the problem.

Slow Helix

This drill is generally used for materials that break up into very small or powdery chips . . . as occurs in drilling brass; hard rubber; thermo-setting plastics such as bakelite; fibre and plastic laminates. These drills are of light construction with wide flutes and are not usually suitable for heavy duty work.

USE CHICAGO-LATROBE CATALOG NUMBER 60

for the most complete listings of drills of all types—plus valuable advice on their use. INCLUDES PRICES.

Maximum Utility, For Precision Work . . . at less cost!

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JIG BORERS

Designed by toolmakers for toolroom work

The Linley Jig Borer is accurate to a high degree. It is fast to set up and position and has the versatility required for precision tool room and die work, yet is low in cost.

Many time-saving accessories are now available for use with the improved Linley that add to its usefulness and simplify its operation.

Check on the many advantages of this improved jig borer. Table size is 7" x 17½"; table travel, 6½" x 10".

Send for descriptive literature.

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boring tolerances in tenths. Layouts of 12 different styles are shown, each differing in tool geometry. Lists 210 sizes ranging from 1.995 to 4.100 in. in diameter, plus carbide inserts in various shapes and grades.

19 ROTARY TABLES—*AA Gage Co, 350 Fair St, Detroit 20, Mich.* 4-page catalog UR-200 presents complete technical and application specifications for high-precision Ultraron rotary tables. Workpieces can be mounted on them for lapping, vertical or horizontal grinding, and inspection. Because the table rotates on special steel spheres, concentricity error can be held to 0.000005 in. (total) and flatness to within 0.00005 in. TIR. Various sizes of tables are available, either with or without air chucking and motorization.

20 MILLING CUTTERS—*Wesson Co, 1220 Woodward Heights Blvd, Ferndale 20, Mich.* 44-page catalog M-860 gives complete specifications on the Wesson lines of throw-away and conventional carbide milling cutters, accessories, blades, parts, and tools. All types of cutters are illustrated and exploded views are included to show simplicity of maintenance. Wesson throw-away insert, and Rigidcut and Varicut inserted-blade cutters are described.

21 SANDING DISCS—*Carborundum Co, PO Box 337, Niagara Falls, NY.* 4-page bulletin A 1558 contains information on a new fiber-backed abrasive disc for lighter grinding operations, where little or no dressing action is involved. Disc has shown superior performance on stainless steel grinding, steel panel spotting and repair, non-ferrous alloys, and blending operations involving solder or plastic fillers. It is available in an aluminum oxide grit range of 24 through 50.

22 AIR GAGING—*Taft-Peirce Mfg Co, Woonsocket, RI.* Catalog 615 describes principles and applications as well as equipment available. Covers company's line of CompAIRators, basic gages for production, inspection, and quality control; the CompUtair, an instrument that provides instantaneous checking of functional relationships such as center distance, taper angle, and squareness of face to bore; complete line of air plug, ring, and snap gages, and other accessories.

23 TEMPERATURE TEST MACHINE —*Marquardt Corp, 16555 Saticoy St, Van Nuys, Calif.* Illustrated bulletin provides information on the TM-1, an autodynamic elevated temperature test machine for testing advanced materials at extreme stresses, strains, and temperatures. Load capacity is 50,000 lb of tension or compression; load rate control range from 0 to 50,000 lb per second. Tests standard ASTM 2 or 1-in. gage length, flat or round; control temperatures are to 5000 F.

HEAT TREATING AND WELDING

24 FLAME-CUTTING MACHINES — *Linde Co, Division of Union Carbide Corp, 270 Park Ave, New York 17, NY.* 28-page catalog (Form 1396) covers complete line of Oxweld units ranging in size from small portable models to huge multi-torch shape-cutting machine capable of reproducing tens of thousands of the most intricate shapes and patterns in steel. Also described is the company's photocell tracer which makes it possible to reproduce complicated metal parts from exact size pencil or ink drawings.

25 INDUCTION HEATING AND MELTING EQUIPMENT — *Ajax Magnethermic Corp, 3990 Simon Rd, Youngstown, Ohio.* 8-page bulletin covers low and high frequency melting; frequency converters and accessories; vacuum melting and degassing; induction billet heaters for aluminum, copper, steel, titanium, uranium, and other metals; charts on selection of proper frequency and melting rates in pounds per hour.

26 VACUUM FURNACES — *Lindberg Engineering Co, 2444 W Hubbard St, Chicago 18, Ill.* 8-page bulletin 800 pictures and describes hot-wall vertical retort vacuum furnaces; horizontal retort models; vacuum bell-type units; cold-wall vacuum furnaces; and a vacuum-atmosphere retort tube for research and pilot-plant use. Units are capable of temperatures up to 3000 F.

27 VACUUM OVENS — *Temperature Engineering Corp, Box NL 1, Riverton, NJ.* 30-page illustrated Tempcor products catalog contains information on VacU-Therm vacuum ovens, diffused Aer-Heet chambers, Sola-Jet radiant ovens, Dri-Box vacuum bake systems, modular controlled atmosphere enclosures, and vacuum equipment. Specifications included.

28 INDUCTION HEATING EQUIPMENT — *Induction Heating Corp, Dept PR-2, 181 Wythe Ave, Brooklyn, NY.* 52-page catalog-handbook pictures latest developments in Ther-Monic equipment for hardening, brazing, forging, soldering, annealing, shrink fitting, and crystal growing. One section deals with improved electronic induction heating generators of bench-type design. Line of work-handling equipment also described.

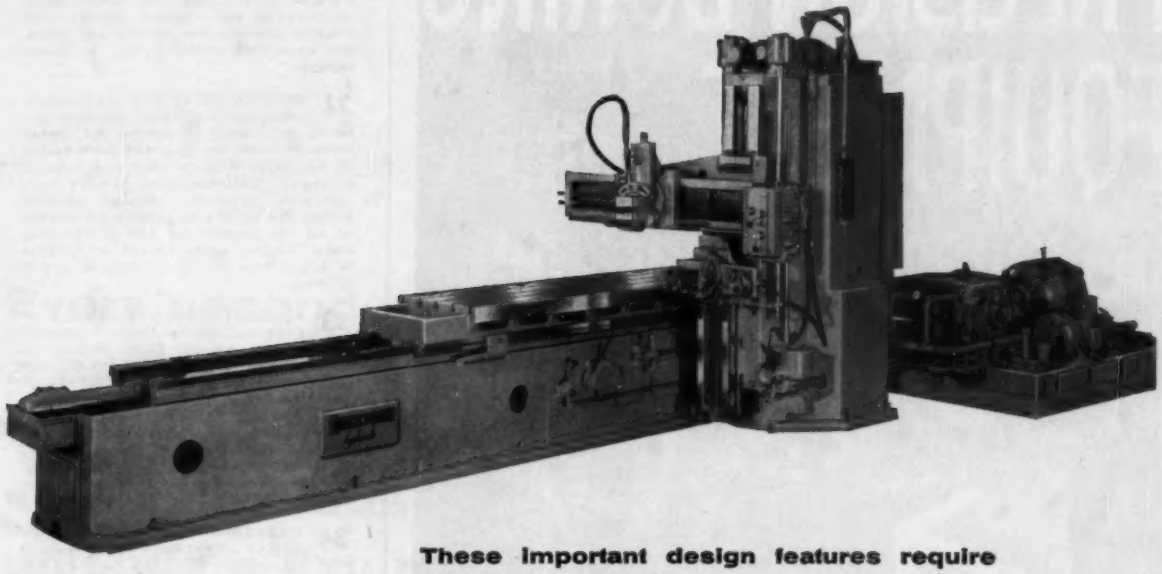
29 WELDING PLASTICS — *Kamlar Products Co, 932 R Washington St, Norwood, Mass.* 4-page illustrated manual 60-2 contains operating and maintenance instruction for welding thermoplastics such as polyethylene, polypropylene, rigid and plasticized tank linings. Includes general description, installation procedure, operating instructions, preparation of material, tacking operation, hand-welding, medium and high-speed welding with round rod and plasticized strip, and application drawings.

30 WALL CHARTS ON FLAMES— *Smith Welding Equipment Corp, 2633 S E Fourth St, Minneapolis 14, Minn.* Two wall charts show the distinctive traits of the Oxy-LP gas flame in comparison with the Oxy-Acetylene flame. Each chart has nine reproductions in color with four illustrations referring to the welding flame and five to the cutting flame. Charts at 11 x 17 in. in size.

"At times I think you take the fact that a secretary is often called an office wife a little too literally."

A little maintenance goes a long way!

...on RMT SHAPER-PLANERS



These important design features require almost no attention:

- Table stays on bedways — Dash-pot cylinders prevent overtravel and running off the bed.
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- Positive mechanical reversals — table-dogs actuate pilot valve for table reversals, feed, and tool lifters — no electrical contactors to wear or fail.

Maintenance is an important factor to consider in any contemplated capital investment. You will certainly want to compare these features with new or present equipment!

For complete information, write RMT Co. — or contact your nearest RMT representative.

ROCKFORD MACHINE TOOL CO. ROCKFORD, ILLINOIS

PRECISION BORING EQUIPMENT...

precision boring equipment
by America's greatest names...

Here's a money-saving way to handle every precision boring problem—no matter what. We'll take your present machinery or basic equipment . . . completely retool and rebuild it to your specifications . . . install it in your plant under the supervision of one of our service engineers, if you so desire . . . and back up our work with a NEW machine guarantee.

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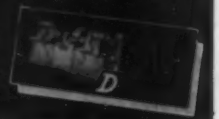
No matter which you choose—whether from our inventory or starting with your machinery, we'll accept complete responsibility for your precision boring problem.

Write for complete money-saving details with an up-to-date list of our current inventories.



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PLANT SERVICE EQUIPMENT

31 CRANES — *Consolidated Crane & Engineering Corp, PO Box 3093, Terminal Annex, Los Angeles 54, Calif.* 64-page manual, catalog 61A on hoists, cranes, and crane components, illustrates and describes end trucks, Gard-Elex enclosed conductors, Load Tamer hoists, crane drives and fluid drive motors, trolleys, runway rails, hanger fittings, and other components for building top riding and underslung cranes from 1 to 15-ton capacity.

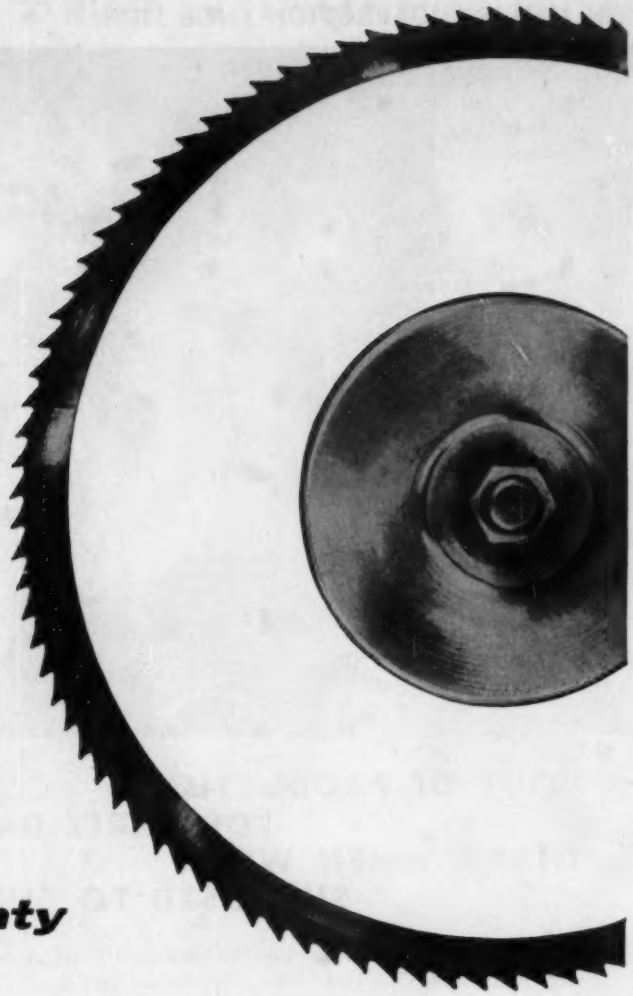
32 RETURN VENT AIR SILENCERS —*Koppers Co, Metal Products Division, 200 Scott St, Baltimore, Md.* 4-page brochure covers the sizes and performance of Aircoustat silencers which are designed to prevent the transmission of noise from one area to another through transfer grilles. The sound trap permits the passage of air but impedes the flow of annoying sound between rooms. It can be installed in a wall or a ceiling, or hung on a wall or door.

33 PHOTOELECTRIC CONTROLS — *Cramer Controls Corp, Electronics Division, Centerbrook, Conn.* 80-page illustrated case history handbook discusses how Infrabeam controls solved 40 typical operational problems in materials handling, equipment and personnel protection, production, and automatic control. Modulated infrared radiation enables this new device to operate by reflected or interrupted beam over an extremely long range, even under high general light conditions.

34 TREATING WATER IN PAINT SPRAY BOOTHS—*Oakite Products Inc, 124 Rector St, New York 6, NY.* 4-page folder F9443 provides directions for maintaining the efficiency of water wash paint spray booths. Discusses the problems which arise from the use of untreated water, then describes the properties that water treating compounds should have for the maximum effect on paint overspray. Lists seven compounds which have proved successful in treating a wide range of organic and synthetic coatings.

35 BLAST CLEANING BARRELS — *Pangborn Corp, Hagerstown, Md.* 16-page bulletin 706 describes features of standard-duty line; contains brief specifications and dimensions of each of the

"I don't mind the rules and regulations, it's the work that's getting me down!"



Every second a cutting tool stands idle while someone loads and unloads a fixture

...costs you plenty

A cutting tool makes money only when it's cutting. The seconds it stands idle while a finished part is removed and a fresh part fed to it are a total loss. That's why dial feeding parts with a Bellows Rotary Work Feeder—the fast automatic way to get parts to and from a machine—can cut machining cost by doubling, often tripling, machine output.

Bellows Rotary Work Feeders, and Index Tables, feed parts swiftly, accurately and safely to the tool—and take them away. All the operator has to do is load and unload while the machine keeps on cutting.

They are inexpensive to buy, inexpensive to install. Like to know more? Phone one of the 200 Bellows-Valvair Field Engineers, or write for Bulletins RT-1022 and RT-1326. Address Dept. AM-261, Bellows-Valvair, Akron 9, Ohio.

Bellows-Valvair
AKRON 9, OHIO
DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

1001-C

TORIT DUST COLLECTION ENDS THIS:

"OUT OF PRODUCTION FOR THREE DAYS? THAT'S WHEN WE'RE SUPPOSED TO SHIP!"

"And believe me, that wasn't all the boss said! Two key machines were so clogged with dirt and grime we had to disassemble and clean them—overnight! Between overtime for the repair crew and our own crew, I managed a partial shipment in three days. And I made up my mind this wasn't going to happen again!

"I'd heard of preventive maintenance with Torit Dust Control equipment—and the Torit representative I called sure opened my eyes! Clean machines hold close tolerances better and up to 80% longer! Torit collectors remove over 99% of dust and air-borne debris, save on both the cost and frequency of servicing.

"I expected there'd be a hitch on prices—but look what I found out: our production breakdown cost nearly as much as the Torit equipment we needed! And just while Torit Dust Collectors are being depreciated we'll make money on them —through maintenance savings, improved production, and reduced down-time!

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five sizes ranging in capacity from 1¼ to 18 cu ft. Outstanding features of the abrasive impeller, heart of each Rotoblast unit, are discussed and pictured.

36 ELECTRONIC AIR CLEANERS — *Westinghouse Elec Sturtevant Division, Damon Rd, Boston 36, Mass.* 8-page catalog 1450 on Precipitron equipment for oil mist control describes the characteristics of the cleaners and points out how they can be applied to collect oil mists resulting from the operation of machine tools.

37 NICKEL SULFAMATE PLATING —*Hanson-Van Winkle-Munning Co. Church St, Matawan, NJ.* 16-page technical instruction bulletin provides data on process, the most suitable bath for heavy build-up for metal resizing, electroplating, electroforming, and other functional uses. Four features of the process are: mechanical properties of deposits are controllable; liquid concentrate solution is chloride free; solution is premixed—no dry chemicals to dissolve, except nickel chloride, when desired. Solution is easy to control. Illustrates (with micro-photographs and charts) and describes solution preparation for both still and barrel operations; effects on deposits of using various proportions of solution's constituents, effective temperatures; equipment and materials needed for operation.

PARTS AND MATERIALS

38 CAST-TOOTH SPROCKETS—*Link-Belt Co, Dept PR, Prudential Plaza, Chicago 1, Ill.* 12-page handbook 2867 lists stock sizes. Sprocket teeth are ground to fit the chain, and selection data is based on this sprocket-to-chain relationship. There are 132 different chain numbers listed and cross referenced to 48 sprocket lists. Basic types of sprockets illustrated include arm center, plate center, segmental, and split rim sprockets and traction wheels.

39 CLUTCHES—*Formsprag Co, 23601 Hoover Rd, Warren (Detroit), Mich.* 42-page catalog 142 covers Rawson automatic centrifugal clutches and clutch couplings designed for a wide range of industrial power transmission applications. Describes basic functions, principal advantages, and performance characteristics; gives dimensional data on the six standard types of clutches available for direct or indirect drive applications requiring either free or delayed engagement. Tables, graphs, and charts provide horsepower ratings, service factors, allowable acceleration, and mounting arrangements.

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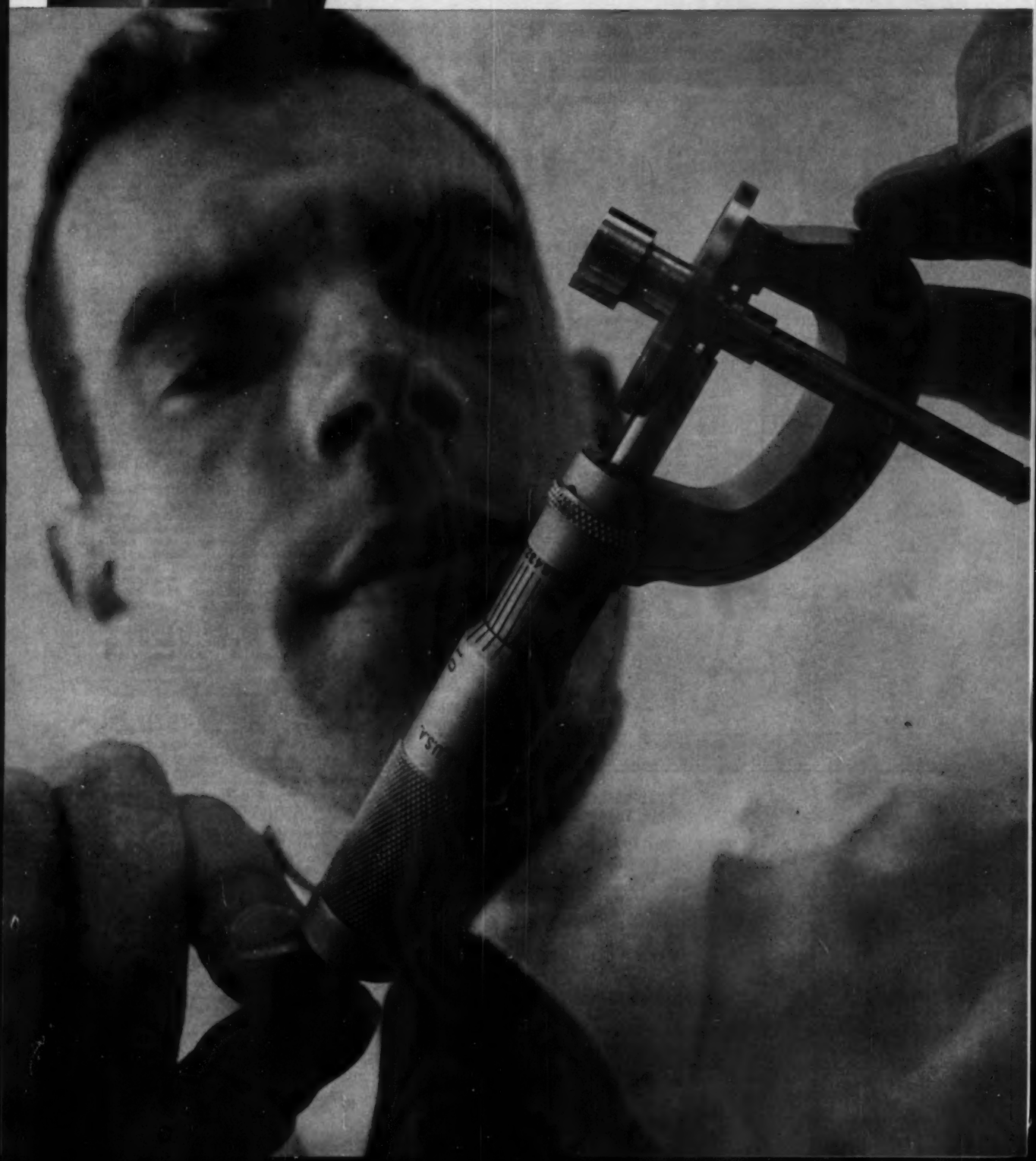

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40 THINLINE MOTORS—*General Electric Co, Schenectady 5, NY.* 8-page bulletin GEA-6927B lists features and advantages of new Thinlines for limited space applications. Illustrated bulletin shows full line rated one through five horsepower in both dripproof and enclosed construction.

41 SPECIAL STEELS—*Heppenstall Co, 4620 Hatfield St, Pittsburgh 1, Pa.* Three data sheets describe characteristics and typical applications of five special steels. Sheet 13 covers Heppenstall R97, an oil-hardening, shock-resisting steel of silicon-manganese type for punches, chisels, wear plates, and other cold work applications where resistance to shock is important. Sheet 14 describes Heppenstall T51, an oil-hardening, nickel-chromium-tungsten type developed primarily for hot and cold trimming applications. Sheet 15 gives data on T71, T72, and T74 steels, chromium-tungsten alloy type tool steels intended for both cold work and semi-hot work applications up to 1000 F where resistance to severe and repeated impact is important. Sheets include instructions for forging, annealing, quenching, and tempering, together with hardness data.

42 GEARS—*Perfect Gear & Instrument Corp, 339 S Isis, Inglewood, Calif.* 128-page catalog 5A contains information on complete line of stock precision I, II, and III gears and precision instrument clamps. Includes diagrams, dimensions, and prices.

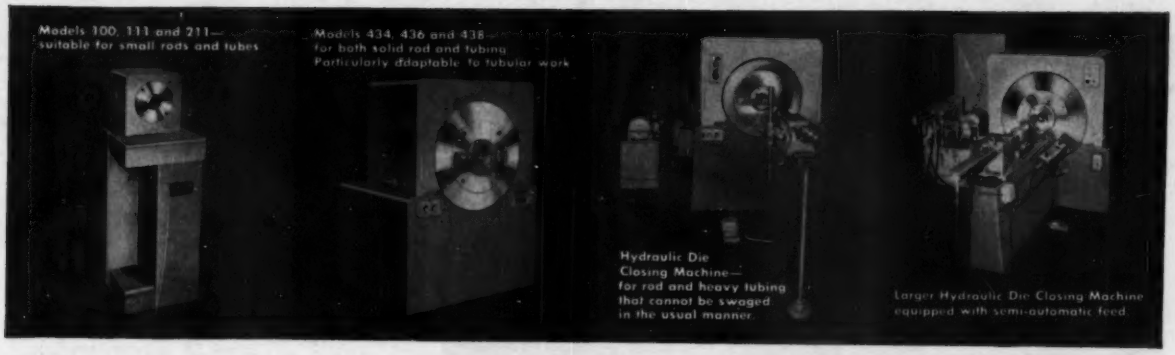
43 ALUMINUM—*Straks Aluminum Co, 800 Snediker Ave, Brooklyn 7, NY.* 186-page catalog-handbook includes indexed and tabbed listing of Alcoa mill products available from stock. Technical information, tables, and engineering data included.

44 ALLOY STEEL SPEC CHART — *Peter A Frasse & Co, 17 Grand St, New York 13, NY.* 8½ x 11-in. chart, Sec D, No. 1, shows the chemical analysis requirements for the more widely used military, Army-Navy aeronautical, and federal alloy steel specifications. Also listed are specified forms (sheets, bars, tubing) and nearest corresponding SAE, AISI, and AMS numbers.

45 ELECTRIC MOTORS—*Louis Allis Co, 427 E Stewart St, Milwaukee 1 Wis.* 8-page bulletin 2651 features 23 types of motors with photos and brief descriptions of application uses and available ratings, enclosures, and modifications.

46 AIR CONTROL VALVES—*Hoffman Valves Inc, 2360 W Dorothy Lane, Dayton 39, Ohio.* Illustrated digest catalog 60-2 presents in a single complete chart the full line of 2, 3, and 4 way, and 4 way 5 port poppet type valves. Air and solenoid pilot operators are illustrated and coordinated in the chart with compatible valves. Inline and sub-base mounted styles are covered. Cutaway drawings show construction features, sealing arrangements, poppets and flow pattern through valves in normal position.

47 GEARMOTORS — *Howell Electric Motors Co, 16316 W Seven Mile Rd, Detroit 35, Mich.* 6-page bulletin describes full line of gearmotors and Line-O-Drive coupled speed reducers. Gearmotors range from 1 to 150 hp, ac; single, double, and triple reduction; with speeds as low as 7.5 rpm. Line-O-Drives are from 1 to 75 hp, ac, with output speeds as low as 1.2 rpm. In addition to descriptive and performance data, two full pages of selection tables tabulate various output speeds for each horsepower rating in all three AGMA Classes. ●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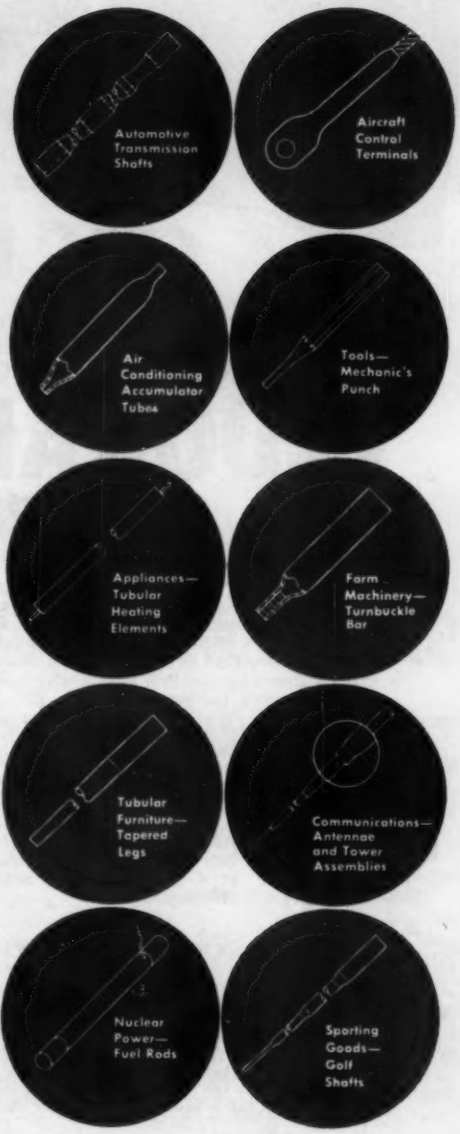

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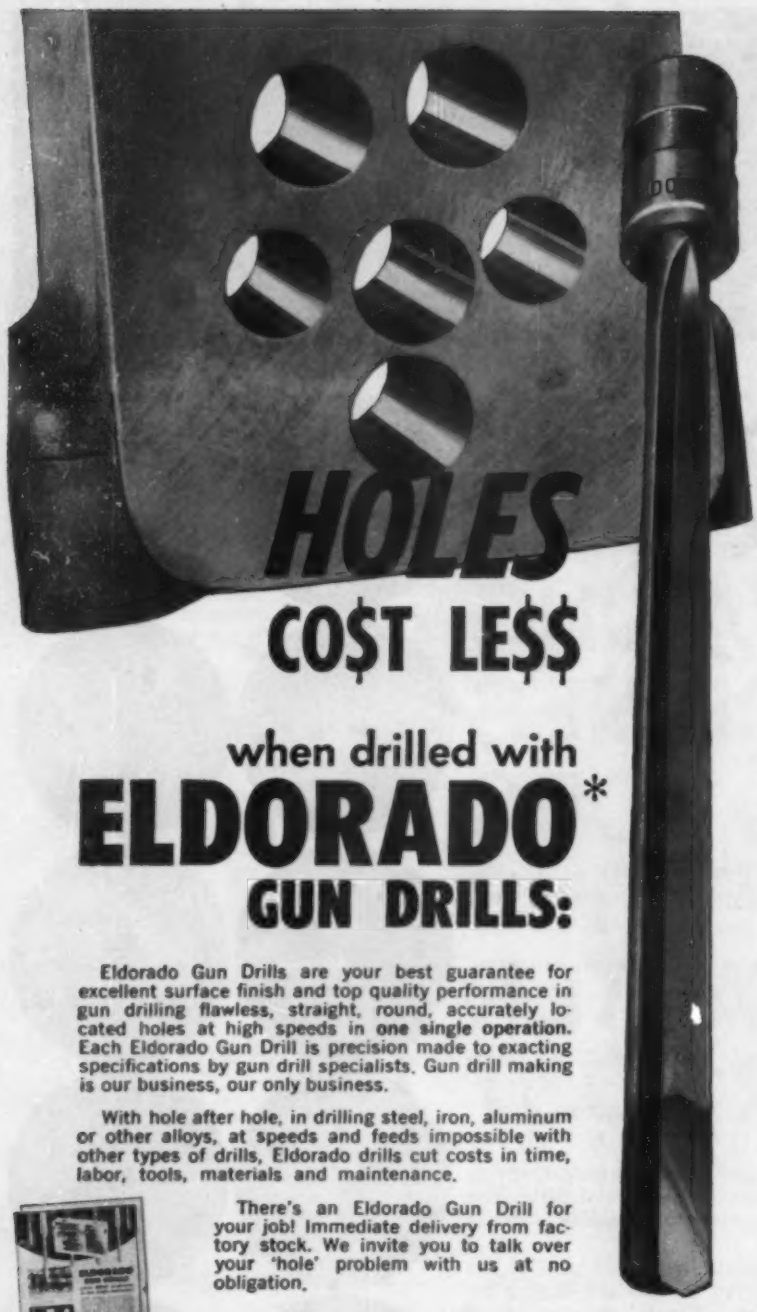

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THE CRISIS WE FACE—*Automation and the Cold War—By George Steele and Paul Kircher. Published by McGraw-Hill Book Co, Inc, 330 W 42nd St, New York 36, NY. 220 pages. Price $4.95.*

Cassandras are never popular and the authors of this book are two of the most outspoken Cassandras heard in modern times. Complex control systems, they feel, are leading us to a crisis in both industry and military applications. They do not question the values, indeed the obvious necessities, for automation, but they feel we are going about it in ways that may lead to disaster.

"Our present military security, our future safety, and even our industrial position are fast coming to depend on automation that has suddenly become enormously hypercomplex. It is no exaggeration to say that in many cases the devices are ten, twenty, even fifty times too complex to be handled effectively with present methods."

This complexity does not arise from the basic nature of automatic control but from our "disintegrated" approach. Picture the man in charge of weapons for a medieval king. He may try to improve the bows and arrows. One man will study feathers, improving breeds of birds, methods of selecting and storing feathers. But will he ever invent a gun?

And if somebody does invent a gun, he will point out how dangerous powder is, how inaccurate the new guns are, and how many people depend on the feather business.

On the B36 bomber there were about 36 gyros, though the authors say only three were necessary. It was easier to repeat the mechanism than to link systems produced by different companies.

Automation may be built up from the bottom by a hodgepodge of commercially available control pieces wedded to conventional machinery. Or it may be down-from-the-top, usually built around a general-purpose digital computer. "Unfortunately, the general-purpose scheme was that chosen for scientific work involving large volumes of computation on a few inputs, but it is unsuited to . . . control in business, where the problem is more often to treat many inputs but to do little mathematical work on each."

Another kind of problem arises out of the complexity of alternatives. Suppose you had a metalworking

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Longitudinal Travel:

Greatest error in any inch.....15 millionths
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Squareness:

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Travel, spindle.....30 millionths in 2¼"

Spindle Axis:

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These users measure to one-third of a "tenth" with Moore Universal Measuring Machine

The tolerances shown at the top of this page will be proven in front of you before final acceptance of the machine, as it was with each customer shown at right.

These users will also attest to the advantages of this machine: its capacity for ultra-precise measuring and inspecting of larger workpieces; the choice of an electronic indicator supported on an accurate, rotatable spindle, or a universal microscope for pickup; a combination of rectilinear and angular positioning, making possible the measurement of the most complex contours. All ways are hardened, ground and lapped steel, fitted to hand-scraped cast iron. Table positioning in two directions of travel is by means of master lead screws. Note motorized lead screw drive, offered as optional equipment.

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General Electric Company — Richland, Wash.
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Catmur Machine Tool Corp., Ltd. — England
North American Aviation, Inc. — El Segundo, California
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Bendix Aviation Corporation — Kansas City, Mo.
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NEW BOOKS...

company, say the authors, and one group of experts feels that explosive forming will save the company a great deal of money and should be developed. Another group advises chemical milling. You can't accept all such proposals, it would tie up too much capital. If you continually turn them down, your methods become obsolete.

While you postpone making the decision, both groups get started anyway and fall into unresolved warfare at lower corporate levels. Finally, one group is forced out, and the decision has made itself.

These examples touch on only a few of the major problems we face that are outlined in this book. The statement of the problems generally is more effective than the solutions proposed, which is to be expected, but perhaps the book will stimulate more study of the problem and help you find solutions for your own organization at least—AA

SUCCESSFUL MANAGERIAL CONTROL BY RATIO-ANALYSIS—*By Spencer A Tucker. Foreward by H B Maynard. Published by McGraw-Hill Book Company, Inc, 330 W 42nd St, New York 36, NY. 436 pages, 6 by 9 in. Price $11.00.*

Can production, sales, and capital statistics be integrated to give management *objective tools* for decision-making? The author of this important new book thinks so. After reading his well-documented presentation, we are inclined to agree with him.

The concept of managerial control by ratio-analysis (called MC by the author) is significant to management in two respects: First of all, it is a new contribution to manufacturing management—unlike any system that has been announced in recent years. Secondly, it explains how to construct (with simple arithmetic) easy-to-use tools that eliminate much of the guesswork in planning and decision-making. No complex mathematics enters the picture here.

What is MC? Basically, it consists of inter-relating business data by constructing what the author calls *elementary* and *advanced* ratios. Elementary ratios might relate, say, indirect-labor costs to total payroll costs, or setup hours to direct-labor hours. Advanced ratios combine two or more elementary ratios, providing

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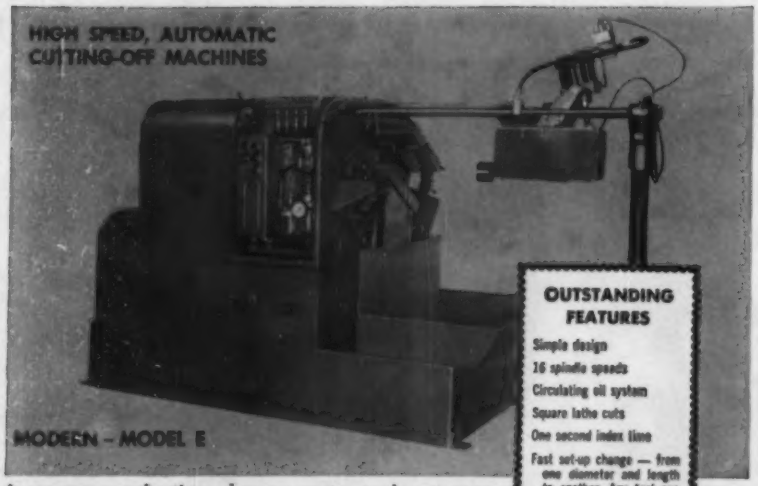

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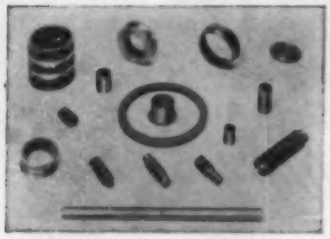

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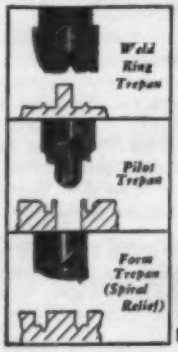

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management with broader, more inclusive statistics. The author develops over 400 elementary and advanced ratios in all areas of company activity.

What the ratios do is this: Compiled at frequent intervals, and examined closely, their up or down movements point out significant trends in company economy. Management can recognize danger signals at an early stage, then take steps to correct them before real trouble develops. Management can act, in other words, while events are taking place, not after they have become history.

Individual chapters show how to compile and relate statistics from such company records as payroll sheets and profit-and-loss statements; how to develop ratios for evaluating production, sales, and capital finances; and how to integrate ratios from all these activities. Hundreds of examples show how the movement of one ratio affects the movement of others.

Perhaps the greatest lesson that MC teaches is that management cannot act on isolated events in the company. An increase in sales, for example, or a decrease in burden, is not in itself justification for decision-making. Ratio-analysis ties in these isolated events with all the other elements in the company's economy. By interpreting the whole, management can plan much more objectively.

The present book is an elaboration of a series of articles written for *AM/MM* by the author in 1957. It should be on every plant manager's bookshelf.—*TJ*

McGRAW-HILL ENCYCLOPEDIA OF SCIENCE AND TECHNOLOGY — *First Edition. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N Y. 15 volumes.*

What a remarkable collection of information the editors have managed to cram into the first edition of this new encyclopedia! In attempting to encompass all the basic information of science in one encyclopedia, the editors set an impossible goal and this edition comes a good deal closer to that goal than seemed possible.

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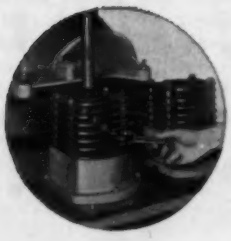

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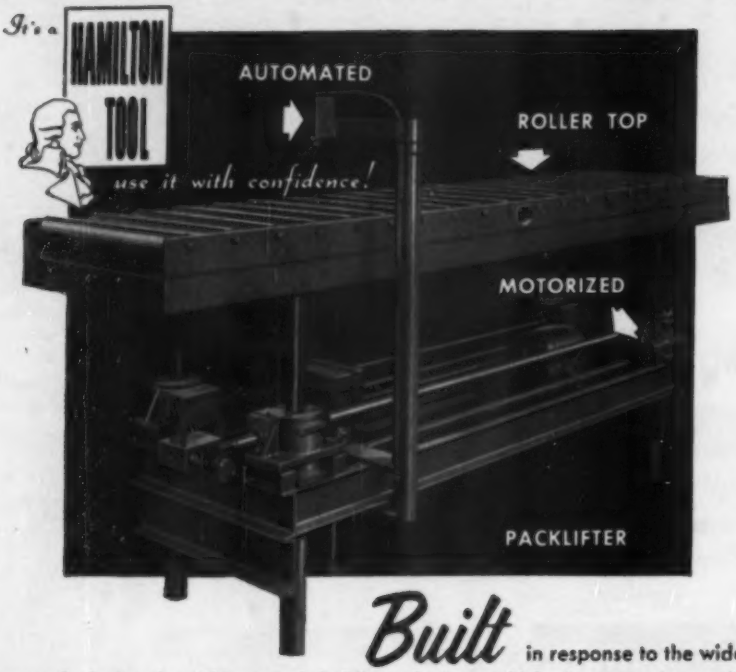

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tunities for just plain browsing.

However, don't make the mistake of thinking you can throw away your handbooks, for it is no substitute for such detailed sources in your own field. Rather it is a useful reference for information in adjacent fields.

As would be expected in a work that requires 87 pages to list the contributors, the quality of the individual articles varies considerably. You'll be surprised at how much basic information is packed into a little more than three pages on *automation*. On the other hand, metal forming is generally covered much more thoroughly than metal cutting.

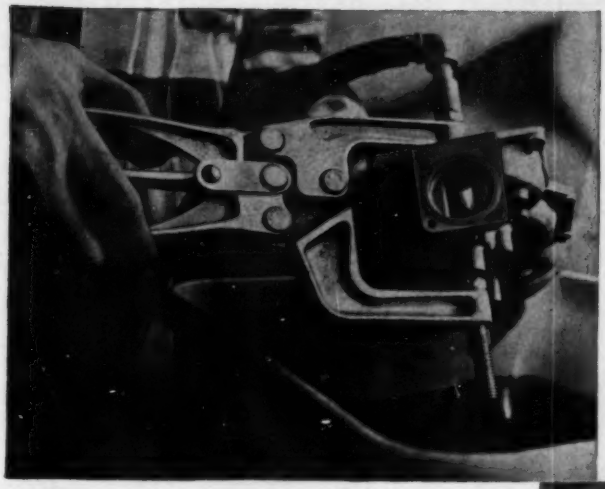
In some cases, relatively new processes are covered quite thoroughly while slightly older methods are missing. Thus *explosive forming* is treated, but this reviewer looked in vain for *electrical discharge machining*.

The encyclopedia strikes this reviewer as being excellent in the basic sciences. If you have a question in optics or interferometry, or something puzzles you on electron theory, the chances are good you'll find the answer.

In many areas of technology, the encyclopedia also stands up well.

Finally, a word about the index. One entire volume has been devoted to the index and an earnest effort has evidently been made to index thoroughly. The quality of the index is far above that of most handbooks and texts. However, even more cross referencing is needed to make it of encyclopedic proportions.—AA •

Look what clamps are doing!



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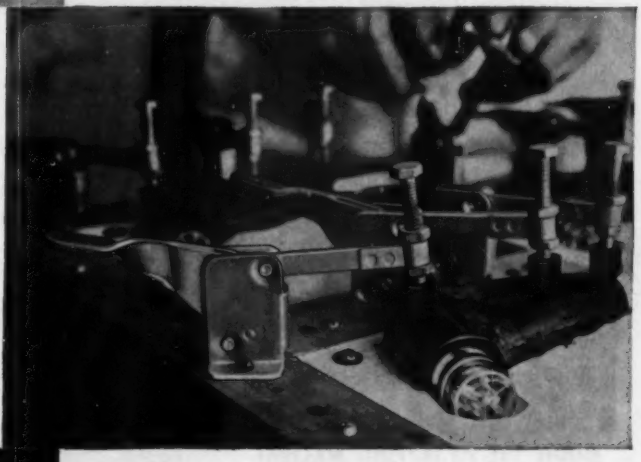

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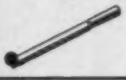

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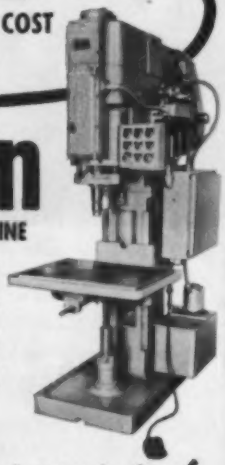

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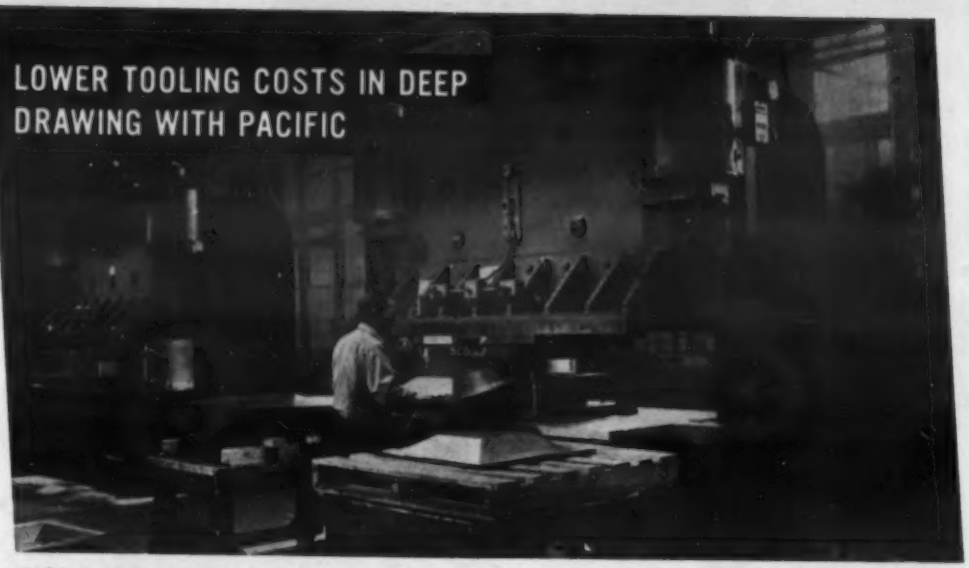

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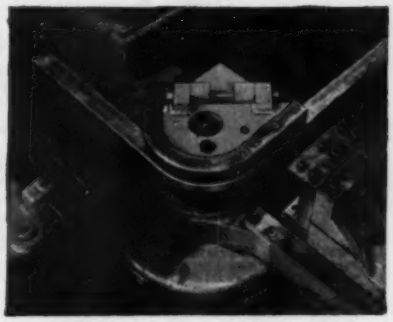

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MACHINERY COMPANY
2848 Pleasant TA 5-4461 Mpls 8, Minn.

CIRCLE 601 READER SERVICE CARD

IMMEDIATE DELIVERY

2—#5 MINSTER HIGH SPEED O.B.I. BLANKING PRESSES, 45 ton, Flywheel type, 1½" stroke, 5 HP Varidrives, Speed range 150-300 SPM. Equipped with #4-6 Perfecto Double Roll Feed and Scrap Cutter. Never used. PRICE: F.O.B. East Boston .....$11,076.00 each

2—#6 MINSTER O.B.I. PRESSES, 60 ton Geared type, 7" stroke, 12" shutheight, 7½ HP Varidrives, 40-80 SPM. Never used. PRICE F.O.B. East Boston .....$9500.00 each

WIGGLESWORTH MACHINERY COMPANY
60 Border St., East Boston, Mass.

CIRCLE 602 READER SERVICE CARD

SEARCHLIGHT SECTION
ADVERTISERS' INDEX AND BUYERS' REFERENCE

Listed below are used, surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name indicates the products or services offered by the advertiser.

1. Accessories
7. Boring Mills
8. Broaching Machines
11. Chucking Machines
17. Drilling & Reaming Machines
18. Electric Motors
22. Forging Equipment
25. Gear Cutting Machines
26. Grinding Machines
31. Lathes
37. Milling Machines
38. Miscellaneous
42. Planers
44. Power Equipment
45. Press Brakes
46. Presses
53. Saws
56. Shapers
57. Shears
66. Welding Equipment

ADVERTISER	Page No.	KEY TO PRODUCTS OR SERVICES
Cincinnati Machinery Co.	222	7, 11, 17, 26, 31, 42
Cook County Machinery Co.	222	17, 26, 31, 37, 53, 56
Eastern Machinery Co.	222	7, 17, 26, 31, 37
Electric Equipment Co.	222	1, 18, 44, 66
Hyman & Sons, Joseph	222	45, 46, 57
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National Machinery Exchange	222	31, 46
Revere Machinery Co.	221	7, 17, 25, 26, 31, 37, 38, 42, 46, 56, 57
Wender Presses Inc.	223	22, 46
Wigglesworth Machinery Co.	220	46

SEARCHLIGHT Equipment Locating SERVICE

"No Cost or Obligation"

This service is aimed at helping you, the reader of "SEARCHLIGHT," to locate rebuilt and used machine tools and equipment, not currently advertised. (This service is for USER-BUYERS only.) No charge or obligation.

How to use: Check the dealer ads to see if what you want is currently advertised. If not, send us the specifications of the equipment and/or components wanted on the coupon below, or on your own company letterhead to

SEARCHLIGHT EQUIPMENT LOCATING SERVICE
c/o American Machinist/Metalworking Manufacturing
Classified Advertising Division, P.O. Box 12, N. Y. 36, N.Y.

Your requirements will be brought promptly to the attention of the equipment dealers advertising in this section. You will receive replies directly from them.

Searchlight Equipment Locating Service, c/o Classified Advertising
American Machinist/Metalworking Manufacturing, Box 12, N.Y. 36, N.Y.

Please help us locate the following equipment:

.....

.....

.....

NAME .....

TITLE ..... COMPANY .....

STREET .....

CITY ..... ZONE ..... STATE .....

2/20/61

PRIVATE PLANT LIQUIDATIONS

Inspect Under Power

NEARLY NEW CONDITION

BORING MILLS

SELLERS 5" Bar Floor Type Horizontal with Floor Plates and Outboard
KING: 42" Vertical Turret Lathe
BULLARD: 36" Vertical Turret Lathe, Spiral Drive
GIDDINGS & LEWIS: #45, 5" Bar, Table Type, Horizontal
GIDDINGS & LEWIS: Model 340T, 4" Bar, Table Type, Horizontal
SELLERS: 5" Bar, Table Type, Horizontal
KING: 100", Heavy Duty Vertical Boring & Turning Mill, 2 Rail Heads, 1 Side Head, New 1943

LATHES

MONARCH: 27"x300" Centers, Model N, 2 Carriages; 18"x72" Centers, Model BB; 16"x54" Centers, Model CY; 27"x150" Centers, Model N; 14"x30" Centers, Model AA; 22"x96" Centers, Model CM
AMERICAN: 40"x312" Centers, 2 Carriages, PRT
PRATT & WHITNEY: 14"x54" Centers, Model C; 16"x54" Centers, Model C
LODGE & SHIPLEY: 18"x54" Centers, Model X; 20"x96" Centers, Model X
NILES: 48"x35' Centers, 2 Carriages, PRT

TURRET LATHES

WARNER & SWASEY: 2A, 3A and 4A Universal, Saddle Type; #5 Universal, Ram Type

GEAR EQUIPMENT

GLEASON: #16 Spiral Bevel (Jobbing Machines), New 1952
GOULD & EBERHARDT: 48H Universal Hobber, New 1944

DRILLS

CINCINNATI BICKFORD: 5' Arm, 15" Column, New 1946 Hardly Used; CARLTON 3' Arm, 9" Column; 4' Arm, 11" Column; 4' Arm, 9 Column; 5' Arm, 15" Column; AMERICAN: 6' Arm, 15" Column (Hole Wizard)

MILLERS

VAN NORMAN: Model 6, 12 and 22L Universal, Ram Type
KEARNEY & TRECKER: Model 4K, 5H and 5HM, Plain, Horizontal
KEARNEY & TRECKER: Model 3K, Universal, Horizontal
KEARNEY & TRECKER: Model 2CH Vertical, New 1954
BROWN & SHARPE: #12 Production, 24" feed New 1948

PRESSES

BIRDSBORO: Cap. 800 Tons Straightening Press, Self Contained, Hydraulic, New 1941
HPM: Model CU-2, Cap. 400 Tons, Self Contained, Hydraulic, New 1949
BLISS: #318, SS, Cap. 1500 Tons, New 1951; #310, SS, Cap. 500 Tons, New 1947; #312A, SS, Cap. 720 Tons, New 1951; #309, SS, Cap. 405 Tons, New 1947; #312, SS, Cap. 720 Tons, New 1947; #60¼, SS, Cap. 1200 Tons
LAKE ERIE: 235 Tons, bed 40"x40", Self Contained, Hydraulic, New 1952
TOLEDO: 06C, SS, Cap. 405 Tons
HAMILTON 4019: SS, Cap. 1000 Tons; #4116½, SS, Cap. 850 Tons; #4013½, SS, Cap. 500 Tons
(All Mechanical Presses with Air Clutch & Cushion)

SHEARS

BUFFALO: #15 Billet Shears, Cap. 8" Round, New 1955, Never Used
NIAGARA: 120"x¾" Cap. Power Shear
CLEVELAND: Model 80-EG-84 Combination Gang Punch & Shear, Cap. 300 Tons, New 1946
CINCINNATI: Model 2510 Power Shear, Cap. 120"x¾", New 1949

JIG BORERS

FOSDICK: #30, Table 30"x18"
PRATT & WHITNEY: Model 2A, 44"x22"

GRINDERS

CINCINNATI: #3 Centerless, Model EA (Filmatic), New 1944
CINCINNATI: 12 x30" Centers, Universal, Model ER
BROWN & SHARPE: #3 Universal
ABRASIVE Model 3B, 8"x24" Surface, New 1946
NORTON: #2 Universal Cutter & Tool, New 1946
HAMMOND: Model 14 SW, Carbide, New 1950

PLANERS

CINCINNATI: 60"x60"x14' (Hypro), Double Housing, 4 Heads
GRAY: 72"x72"x20' Open Side, Vary Voltage Drive, 2 Rail Heads, Side Head, New 1942

SLOTTERS AND SHAPERS

GOULD & EBERHARDT: 32" Universal Shaper; 16"-20" Shaper
ROCKFORD: 36" Vertical Slotter, Hydraulic, New 1946

MISCELLANEOUS

YORK: Model SPH 54-210-6 (Steam Pak Boiler) 250 HP, New 1958, Never Used
CHICAGO (DREIS & KRUMP): Model 60SD Press Brake, Cap 7/10"x12', New 1949
CHAMBERSBURG: 3000 lb "Ceco" Hammer, New 1952
AMERICAN: H-20-60 Horizontal Broach
HAYES: Model LR-90 and HG 80 Electric Furnaces
ALSO: Key Seaters, Saws, Tool Grinders, Gear Shapers, Transformers and many others too numerous to mention.

Jeffrey Automatic Metal Scrap Handling System, 100 HP Crusher, Conveyor, Bucket elevator, storage hopper nearly new condition.

SALES VALUE OVER $2,000,000!

Contact BOB HIMOFF

REVERE MACHINERY CORPORATION

415 LEXINGTON AVENUE, NEW YORK 17, N. Y.

MUrray Hill 2-5424 • Cable: Machrev, New York

EASTERN

Rebuilt Machine Tools

THE SIGN OF QUALITY—
THE MARK OF DEPENDABILITY

84" Cincinnati Hypro Boring Mill, A.C. 1944.

4'11", 4'13", 5'13", 6'17" American hole Wizard Radial Drills, all 1944, all excellent

24" x 72" Landis Type F Plain Cyl. Grinder, extra heavy, latest model, new 1955.

36" x 48" Landis Type CHW Universal Grinder, latest model, new 1955, practically new.

42" x 72" Norton Plain Grinder, two machines, both practically new, latest models.

25" raised in sand to swing 36½" Monarch Lathes, two have tracers, 1953 machines.

No. 3 Cincinnati Dual Power Plain Miller, 1951 machines, excellent condition.

28-60 and 36-168" Cincinnati Vertical Hydrotels, one new in 1930, 360 tracer.

No. 420 and 445 Barnes 2 spindle deep hole drilling, boring machines, excellent.

No. 2 MI Cincinnati Plain Miller, 1952.

3½" bar Cincinnati Gilbert Table type Hor. Boring Mill, 72" vertical travel.

100" Niles Vertical Boring Mills, two machines, one hydraulic, both cheap.

48" Niles Car Wheel Borer, hydraulic feeds, two speed motor, late, exc.

THE EASTERN MACHINERY CO
1004 Tennessee Avenue, Cincinnati 29, Ohio
MElrose 1-1241 CABLE ADDRESS EMCO

CIRCLE 604 READER SERVICE CARD

BRAKES PRESSES SHEARS

Will Lease or Furnish Long Terms

JOSEPH HYMAN & SONS
2600 E. Tioga St., Philadelphia 34, Pa.

CIRCLE 605 READER SERVICE CARD

Cimco

90" x 48" x 18' Cincinnati Hypro Double Housing Planer, DC motor with AC planer M-G set, 4 heads, pneumatic tool lifters.
72" x 72" x 18' Cincinnati Hypro Double Housing Planer, new 1943, 4 heads, pneumatic tool lifters.
96" x 96" x 20' Cincinnati Hypro Double Housing Planer, 4 heads, pneumatic tool lifters, late.
6'10" column American Holoviard Radial Drill column extended 2', 32 speeds, late.
14" x 12' x 36' Betts Double Housing Planer, 50 HP DC motor, 4 heads, box table. ACTUAL PHOTOGRAPH AVAILABLE.
10" x 40" x 90" centers Norton Type "C" Cylindrical Grinder, two gaps, swing 40 x 28" in gaps, mechanical feed, late type.
22" x 24" centers Monarch Model CM Geared Head Lathe, actual swing 27½", 16 speeds, two Carriages, taper. Model 300 Hanchett, 13 x 48" table, complete with magnetic chuck and rectifier late type.
24" x 72" Sidney G.L. late, 16 speeds, Timken bearing, taper attachment.
4A Warner & Swasey Saddle Type Turret Lathe, 24" 3 jaw chuck, 6¼" hole in spindle.
5" bar Gaddings & Lewis horizontal boring mill, table 52"x59", 12 speeds, outer support.
8'10" column Foodick Radial Drill, motor on arm 20 HP AC, mounted on floor plate 19' long, 14' wide, 35 spindle speeds.

Cincinnati Machinery COMPANY
3901 Kellogg Ave., Cincinnati 26, Ohio
Phone TR 1-0853

CIRCLE 606 READER SERVICE CARD

7'17" American Radial, Late
#3 and #4 Kling Friction Saws
#5H K & T Plain Mill, Late
½" Kane & Roach Shape Straightener
27"x22" c Niles Lathe, Late
14"x36" Mattison Hyd. Surface Grinder
6x18 Thompson Hyd. Surf. Grinder
4'15" Cinc Guilbert Radial drill Elec. arm & Column Clamp Rapid Traverse
Send for our complete listings.
COOK COUNTY MACHINERY COMPANY
1035 W. Lake Street, Chicago 7, Illinois

CIRCLE 607 READER SERVICE CARD

MOTORS • GENERATORS
TRANSFORMERS
NEW • REBUILT
ELECTRIC EQUIPMENT CO.
WORLD'S LARGEST INVENTORY
CALL COLLECT CL 4-9058
P.O. BOX 51 • ROCHESTER 1, N.Y.

CIRCLE 608 READER SERVICE CARD

WANTED for promotion and manufacture

Industrial Specialties with limited market potential.

P.O. Box 2063 Dayton 29, Ohio

CIRCLE 609 READER SERVICE CARD

MANUFACTURING MANAGER
$18,000 - $25,000
Southern California

Division of major, established manufacturing company requires Manufacturing Manager with 15 to 20 years experience heavy metal forging, forming and fabrication, preferably in the machine tool industry. Must be both technically and administratively competent. Age to 55. Send complete resume and earnings record to:

Barry and Company
727 West Seventh St. (Room 855)
Los Angeles 17, California

CIRCLE 610 READER SERVICE CARD

ADDRESS BOX NO. REPLIES TO:
Box No. Classified Adv. Div. of this publication.
Send to office nearest you.
NEW YORK 36: P. O. BOX 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 11: 255 California St.

BUSINESS OPPORTUNITY

British machine tool manufacturer is prepared to supply on reciprocal basis all technical services for United States counterpart to produce and market in North America branded sheet metalworking equipment as used by some of the world's largest organizations. Existing designs embrace uncoilers, slitters, recoilers, cut to length lines etc. BO-6017, American Machinist.

PRACTICALLY NEW PRESSES

825 tons, Bliss #80½-60 Bed 60"x54", Str. 5"
180 tons, Bliss #61½-90 Bed 90"x30", Str. 6"
250 tons, Minster 84"x48" Str. 12"
Warco 500 Tons Double Crank Bed (80"x84" Double) Roll Feed, Uncoiler, Straightener
135 tons, Bliss #6-48, Bed 48"x30"
100 tons, Bliss #5-36, Bed 36"x22"
75 ton Minster Pacemaker Model #P-2-75-36
Bliss #6150 High Speed Double Roll Feeds
Bliss 6458, Bed 48"x18", Str. 4"
LeBlond Engine Lathe, Type NK, 30" swing x 27' centers, 2 carriages
Practically New Leavy Hydraulic Triplex Pumps equipped with Westinghouse 500 HP motors, Farrel Sealed Gear Cases, and starting equipment

"If it's machinery; We have it."

NATIONAL MACHINERY EXCHANGE
138 Mott St., N. Y. CAnal 6-2470

CIRCLE 612 READER SERVICE CARD

Want More Information on Searchlight Advertisements?

- Take advantage of the service available on Classified advertisements to secure more information. Use the handy, prepaid reader service cards (at the end of the magazine) to bring you more data. The Reader Service number appearing under each advertisement need only be circled on the card.

- Use this time-saving service to keep abreast of the latest in used, rebuilt, surplus new equipment, employment or business opportunities.

Nearly New (Up to 1955)

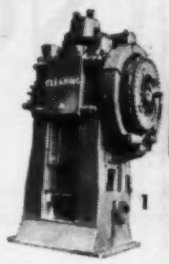
FORGING and STAMPING Equipt.

at a fraction of new cost... Save up to 2/3rd.

- LATE MODELS • LOWER CAPITAL INVESTMENT
- MONEY BACK GUARANTEE • INSPECTION UNDER POWER

FORGING PRESSES

Suitable for Hot Forging, Coining, Blanking, Forming and Impact Extruding. All presses have Air Clutch and Brake. Most have positive Knock-outs in bed and slide, and power operated Die Seat (Wedge) adjustment.

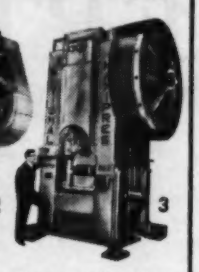


1

1600 Ton CLEARING
1952
Selling Price **$90,000**
New Price $200,000 (approx.)
Mdl. EF-1-1600, Bed 42"x46" 12" Stroke, 65 Str. pr. min.

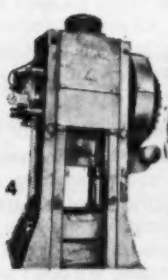
2

1600 Ton BLISS
1952
Selling Price **$90,000**
New Price $200,000
Mdl. FS-1-1600, Bed 38"x46" 12" Stroke, 70 Str. pr. min.



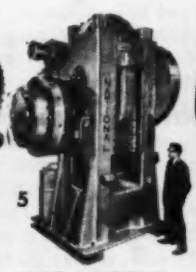
3

1300 Ton NATIONAL
1955
Selling Price **$49,500**
New Price $132,000
No. 1300 Maxipres, 10" Stroke, 80 Str. pr. min.



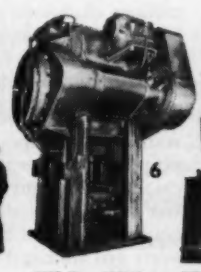
4

750 Ton CLEARING
1952
Selling Price **$36,500**
New Price $75,000
Mdl. EF-1-750-27½, 8" Stroke, 80 Str. pr. min.



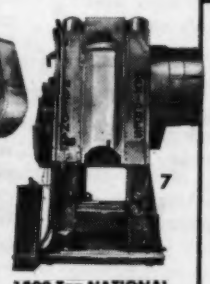
5

750 Ton NATIONAL
1943
Selling Price **$25,000**
New Price $70,000
No. 3 Maxipres, 10" Stroke, 50 Str. pr. min.



6

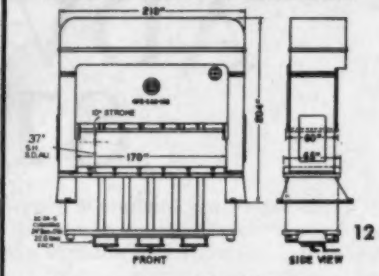
750 Ton BLISS
1952
Selling Price **$36,500**
New Price $75,000
Mdl. F-51-750, Bed 36"x34", 6" Stroke, 85 Str. pr. min.



7

1200 Ton NATIONAL
1943
Selling Price **$49,500**
New Price $122,000
No. 4 Maxipres, 8" Stroke, 80 Str. pr. min.

WIDE BED PRESSES

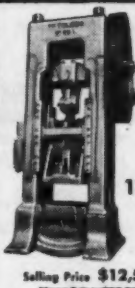


12

380 Ton BLISS
Bed Area: 170" x 65"
Selling Price **$35,000**
New Price $95,000

3 Presses available. Cushions extra. Mdl. 4PE-380-168, 10" Str., 18 Str. pr. min. For Blanking, Drawing, Forming and Progressive Die Operations.

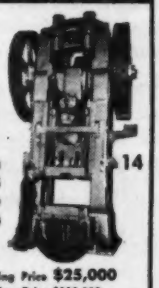
SINGLE CRANK PRESSES



13

440 Ton BLISS TOLEDO No. 59¼

920 Ton BLISS TOLEDO No. 60

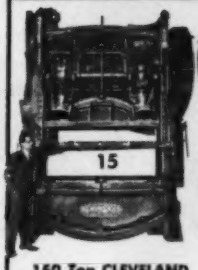


14

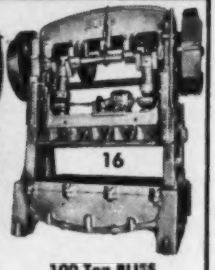
Selling Price **$12,500**
New Price $30,000
Bed 41"LR x 48"FB, 12" Str., 29" S.H. Air Clutch, Air Cushion.

Selling Price **$25,000**
New Price $110,000
Bed 46"LR x 72"FB, 20" Str., 36" S.H. Air Clutch, 14 SPM. For Blanking, Trimming, Coining, Impact Extruding, Drawing.

DOUBLE CRANK PRESSES



15



16

150 Ton CLEVELAND
60-D-84
Selling Price **$8,500**
Replacement Cost $40,000
Bed 86"LR x 46"FB, 14" Str., 31" S.H. 33 SPM. Air actuated friction clutch. For Blanking, Drawing, Forming, Die Tryout.

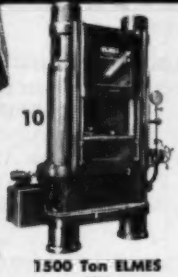
100 Ton BLISS
Consolidated No. 166D
Selling Price **$7,500**
Replacement Cost $40,000
Bed 84"LR x 48"FB, 12" Str., 30" S.H., 17 SPM. Air Clutch. For Blanking, Drawing, Die Tryout.

HYDRAULIC PRESSES

9

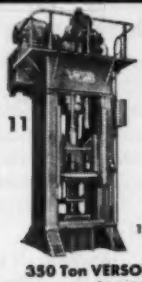
1943

2000 Ton CLEARING
Selling Price **$30,000**
New Price $130,000
Mdl. H-2000-54, Bed 56"LR x 48"FB, 18" Down Str., 64" Open Ht., 250 HP. Speeds (in./min.): 900/600/35. Two presses on orig. foundations. For Drawing, Forming, Piercing, Coining, Hobbing and Blanking.



10

1500 Ton ELMES
1952
Selling Price **$12,500**
New Price 140,000
Mdl. 4477, 12" up-stroke, 32" daylight, 3 post constr., 34½" bet. posts. For Hobbing, Drawing, Forming, Coining and Blanking.



11

1944

350 Ton VERSON
Selling Price **$15,000**
New Price $35,000
Mdl. 350 HD4CT, 32" Down Str., Bed 40"x40", 70" Daylight, 125 HP. Speeds (in./min.): 685/914/76. For Blanking, Forming, Coining and Impact Extruding, Drawing.

8

3000 Lb. "Coes-Drop" HAMMER
1951
Selling Price **$17,500**
New Price $22,000
Chambersburg Mdl. 30CD, Air or steam lift. Gravity drop forging hammer.

We pay highest prices for your surplus presses

Phone TRinity 2-1270 **Cable Address: "Wenderpres" U.S.A.**

Wender PRESSES, INC.
1957A CLAY AVE. • DETROIT 11, MICHIGAN

Check appropriate square and clip to business card or letterhead for specifications.

☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9
☐10 ☐11 ☐12 ☐13 ☐14 ☐15 ☐16

Check here for complete stock and price list ☐

WHAT WOULD HAPPEN IF ALL ADVERTISING STOPPED?

Stores would begin cancelling orders. Very quickly, manufacturers would close down plants and lay off millions of employees. Volume production would be a thing of the past . . . and so, prices would rise fast.

Within a week most radio and television stations would close up shop for lack of revenue. The ability of many newspapers and magazines to perform their full, vital functions would be seriously impaired. And the cost per copy would zoom for those that tried to keep running only on circulation revenues.

This alternative to advertising can hardly be the goal of the critics of advertising. Without advertising our national economy, our national *life*, would be bleak indeed. In many ways, advertising is the *power plant* of our society.

MORE CUSTOMERS FOR MORE PRODUCTS—American creative genius and wonderful ability for organization have resulted in a tremendous flow of goods of all kinds. This creates a crucial need for *masses* of people anxious, willing and able to *buy* and *consume* these goods. Only a society with a constantly *rising* standard of living can provide the customers. These customers have to be sought, taught and often *persuaded* to move higher in the scale of living. This is the job of advertising.

Advertising not only gives people news about new products, but provides the *urge* for people to own and enjoy these products. The wider and deeper the penetration of our products into the life of America, the greater the need for more production. This means more jobs. More jobs mean more people able to enjoy what we make. More people buying means more, still more production. And so on and so on. The result is that more Americans can enjoy more of the fruits of their labor than people in any country anywhere in the world can enjoy theirs.

ADVERTISING LOWERS PRICES—Does advertising raise the cost of goods? On the contrary. Through newspapers, television, magazines, radio and billboards, an advertiser can talk to a prospect for a tiny fraction of a cent. Advertising is the quickest and cheapest way of reaching large numbers of people. It enables the advertiser to reach his market (customers) inexpensively and thus increase his total production, thereby reducing the cost of making and selling each unit.

THE CULTURAL EFFECTS OF ADVERTISING—It's because of *advertising* that our mass media of communication can afford to command the finest talent for bringing to the American people information, stimulation, entertainment and education which in other countries are available to just a very few people.

Advertising makes its cultural contribution in another way. Advertising is in large measure responsible for better living, less drudgery, more leisure for more people. This creates opportunities for intellectual and spiritual activities equaled in few, if any, other countries. While millions and millions of dollars are being spent by Americans for cars, boats, sports equipment and the paraphernalia of leisure, there is a growing *hunger* for improvement of the mind and for aesthetic enjoyment.

WHAT ARE THE "NEEDS" OF THE PEOPLE?—Critics of advertising sometimes indict it for creating dissatisfaction in people's minds with what they have, and persuading and cajoling them into buying what they neither need nor want. But what are "needs?" The "needs" of people in undeveloped countries are not the same as our needs. Our needs of 50 years ago are not the same as they are today. We don't actually "need" electric razors, electric refrigerators, vacuum cleaners, television sets, shampoos, beauty treatments, packaged goods, or even automobiles. But would the critics of advertising stop encouraging people to want a better life? Would they have the millions of people who create, produce, and market the so-called "non-essentials" thrown out of jobs? Do they want us to go back to the more primitive living of other countries?

ADVERTISING—PUBLIC SERVANT—Frequently, the advertising industry is called on to direct public-service jobs—for the Government as well as for private public-service organizations. This it does through the Advertising Council, a nonprofit organization supported by American business and advertising media. Here's what President Eisenhower said to the Advertising Council in Washington several months ago:

"For eighteen years you have been stimulating the nation's conscience in areas where the voluntary work of great numbers of people has been necessary in order to promote worthwhile causes. I know you have been in such fields as conservation, organized charities, safety, prevention of accidents, and more recently in giving your efforts to the job of pointing out to our people the need for self-discipline if we are to avoid debasement of our currency and prevent inflation.

"And I think no other body has done more in this regard in trying to inform America across the board of these things than The Advertising Council."

Prepared in the interest of wider understanding of advertising with the assistance of the Bureau of Advertising, ANPA.

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YOU CAN FIND IT QUICKER AND EASIER IN SWEET'S MACHINE TOOL CATALOG FILE

CIRCLE 320 READER SERVICE CARD

This is how you read 1 oz. on ordinary scales

This is how you read 1 oz. ON DETECTO OVER-UNDER SCALES

Big 'travel' magnifies slightest weight discrepancy... prevents your profits dribbling away, ounce by ounce. Send for specifications.

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Dept. MA
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PRECISION SET-UP FOR PRECISION GRINDING WITH

ANTON MAGNETIC ADJUSTABLE V-BLOCK

Unsurpassed for layout, toolroom and production. Can be used on any machine equipped with magnetic chucks.

SAVE MONEY, TIME AND LABOR

- Vernier accuracy: ±15 seconds
- Parallelism: ±.00005 over entire length
- Size: 6" long, 4½" wide, 2½" high

Write today for complete technical data to:

ANTON MACHINE WORKS
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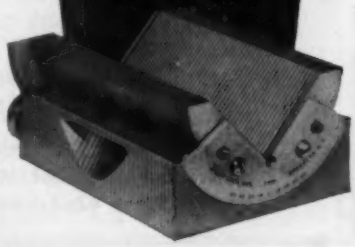
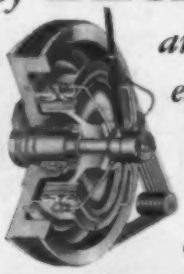
Brooklyn 37, N. Y.



CIRCLE 322 READER SERVICE CARD

High Production Presses by **DECHERT**



are equipped with the exclusive

ZEH-FLEX
"frame-supported"
AIR CLUTCH

- *Non-Deflecting Flywheel*
- *Self Adjusting Clutch*
- *360° Friction Surface*
- *Air Dampens Harmonics*
- *Instantaneous Engagement*
- *Automatic Wear Adjustment*
- *Eliminates Sudden Shock*
- *Less Heat Generation*
- *Electric Controls*
- *No Back Lash*
- *Reversible Clutch*

Unlike some conventional presses that at best rely on "beefed-up" crankshafts to support the full load of the air clutch, the ZEH-FLEX is Frame-Supported. . . eliminating oversize crankshafts and reducing wear. This is done by resting the air clutch on a bearing support (or quill) which is mounted on the frame. The crank shaft passes through the bearing support, thus freeing it from the damaging effects of centrifugal force.

A ZEH-FLEX Air Clutch installation includes the following electro-pneumatic controls for hand operation by one operator: One start button, one top stop button, one emergency stop button, one selector switch for inch—single—continuous stroke and two "plug-in" type micro switch receptacles.

Other operating features such as electric tachometer, remote speed control, D.C. circuitry etc., available on request.

Write, wire or phone for descriptive literature.

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MODERN TECHNIQUES COMBINE TO LOWER SHORT-RUN MANUFACTURING COSTS

The combination of numerical control, automatic tool change, automatic work transfer and good process planning spell the answer to ever-increasing costs found in short runs. A compilation of current thinking may be found in 16-page reprint for 35¢ from

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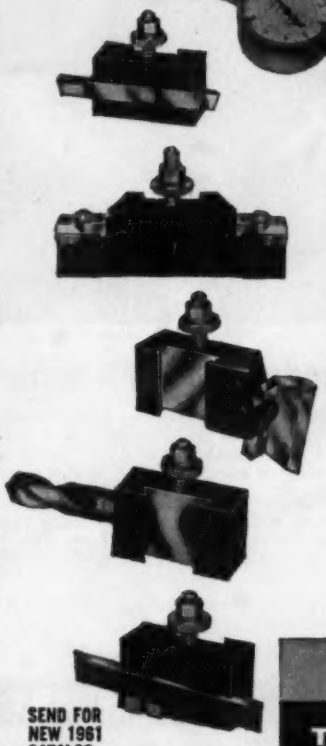
±.0001" ACCURACY
with the New ALORIS Super-Precision Quick-Change Tool Post and Tool Holders

"no lathe owner can afford to be without it"



Now Aloris Quick tool changing versatility and flexibility is combined with the closest repeating tolerances for the most exacting jobs. No matter how many times tool holders are changed, .0001" tolerance is maintained, even when deep boring. A patented tapered sliding Gib tool post, pulling in on the holder provides this most positive lock assuring absolute rigidity. All surfaces are hardened and precision ground. You can always rely on its accuracy for the most critical tolerances.

Another advanced development that proves Aloris leadership as the most modern and complete line of "Quick Change" tooling available . . . the only quick change Tool Holders recommended by America's leading lathe manufacturers.

- CHANGE TOOLS IN SECONDS
- NO TIME WASTED WITH SHIMS
- RUGGED — NO CHATTER OR VIBRATION
- UNLIMITED VERSATILITY
- COMPLETE SATISFACTION GUARANTEED

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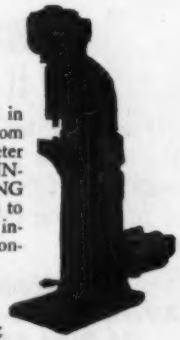
CIRCLE 325 READER SERVICE CARD

GRANT

RIVETERS — PIONEERS in their line — head rivets from smallest to ¾" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method — Sizes to meet all needs — Types include Vertical and Horizontal Multiple Spindles.

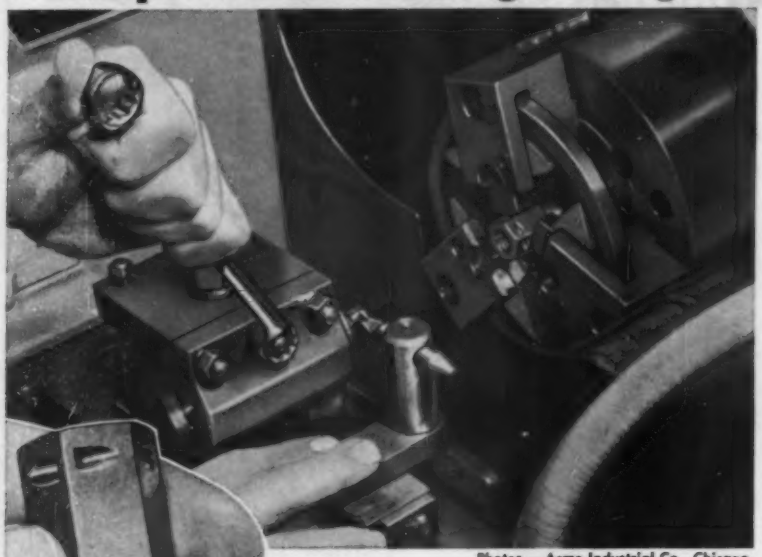
Write for literature and don't forget to send samples.



THE GRANT MFG. & MACHINE CO.
85 Silliman Ave., Bridgeport, Conn. U. S. A.

CIRCLE 326 READER SERVICE CARD

Buck chuck on Gisholt CRI-DAN helps make amazing savings



Photos — Acme Industrial Co., Chicago

Smart production 467% faster!

The problem: a 20 NF Class 3 thread up to shoulder in bore on hex end of 440C stainless spool valve. Tapping was slow, breakage excessive . . . hardening shrunk and distorted threads . . . rejects as high as 20%.

The solution: A CRI-DAN lathe with a Buck compensating chuck, with internal pilot bushing, to center and grip work instantly for automatic taper threading with .4675" go—.4701" no-go precision. Result: 5.03 *minutes saved per part . . . no rejects.*

In your shop, too, you'll make money *every* time you chuck with Buck.

FREE catalog write—

Makers of Scroll, Power, Dust Proof, Independent Chucks.

BUCK TOOL COMPANY

210 SCHIPPERS LANE • KALAMAZOO, MICH.

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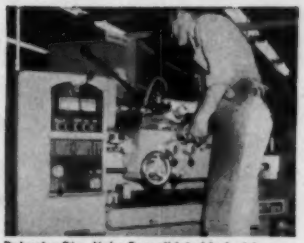


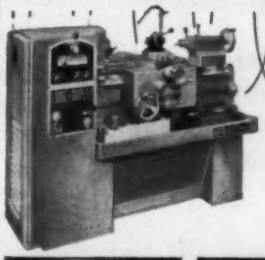
Dalmotor Div., Yuba Consolidated Industries . . . "used in model shop for turning, facing and boring all sorts of experimental parts."

Raytheon Manufacturing Co. . . . "used for turning, facing and boring operations on brass, aluminum and steel workpieces."

Over an extremely wide range of American industry . . . for tooling, production, maintenance and experimentation . . . the Lodge & Shipley 1307 HI-TURN (10") Lathe is making a record of true economy. With literally dozens of big lathe features, the HI-TURN is still priced substantially below many lathes having fewer features, less horsepower and lighter construction.

Turn your attention to HI-TURN. Find out why these and many other lathe users are ordering and reordering HI-TURN Production and Tracer Lathes to replace or supplement larger, far more costly lathes. For complete details, request Bulletin 331, The Lodge & Shipley Co., 3056 Colerain Ave., Cincinnati 25, Ohio.

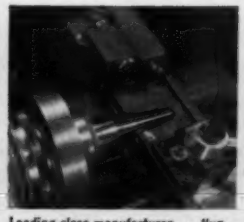
THEY'RE ALL TURNING TO Hi-Turn



. . . your Lodge-ical choice

Lodge & Shipley

Rocketdyne Div., North American Aviation . . . "held OD turning to a tolerance of .0003"."



Leading glass manufacturer . . . "unheard of economy, ease and speed of production" on machining and reworking glass bottle tooling.

Indiana Gear Works . . . has earned a reputation of "excellent for high production."

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HOW TO WRITE BETTER REPORTS

How many times have you fought your way through a wordy, difficult hard-to-read report that, with a little effort, could have been made easy to understand and digest. Here's a pocket-sized, 26-page, booklet that will assist anyone who has to write reports. It's available for 50¢.

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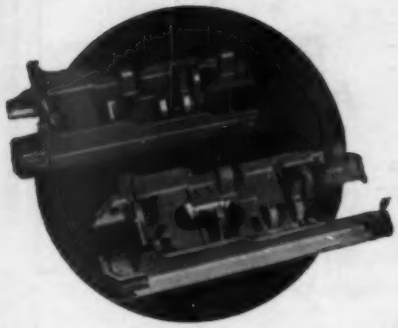
Sub-contracting precision parts, assemblies and machines like these... is our business!

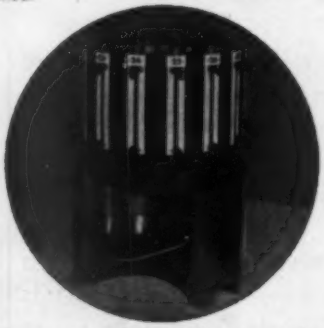
(but we want more of it)

We'd also like to prove to you what our completely integrated manufacturing facilities* can mean to you in terms of lower costs, faster delivery, and complete satisfaction.

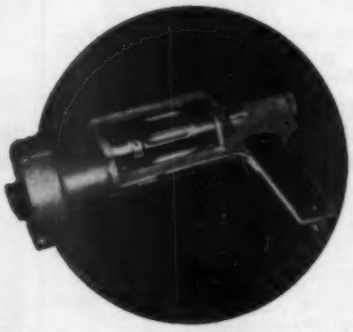
TMW's facilities and 65 years' experience in high-precision (tolerances to tenths) manufacturing are available to you *now*, on a short or long-term basis. For details or a new Facilities File Folder, call or write today.



A TMW gray iron casting before and after precise machining, annealing and finishing operations were performed.



Paint dispenser was economically mass produced for a major manufacturer in TMW's modern shops.

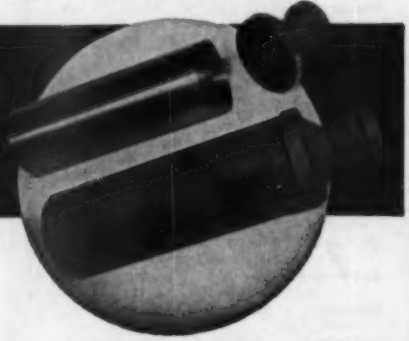


"The world's first and only automatic stud fastener" . . . (another example of TMW precision machining and assembly) carries a LIFETIME guarantee.

* Includes 1,000,000 sq. ft. of manufacturing space, 1200 *modern* machine tools, completely mechanized foundry (one of the world's largest), 3000 skilled craftsmen with a corps of top designers and engineers.

TEXTILE MACHINE WORKS

Contract Division • Reading, Pennsylvania



Jato units, used on the "Honest John" rocket to make it spin, are machined to ±.0002" tolerances and hydrostatically tested to meet strict government specifications.

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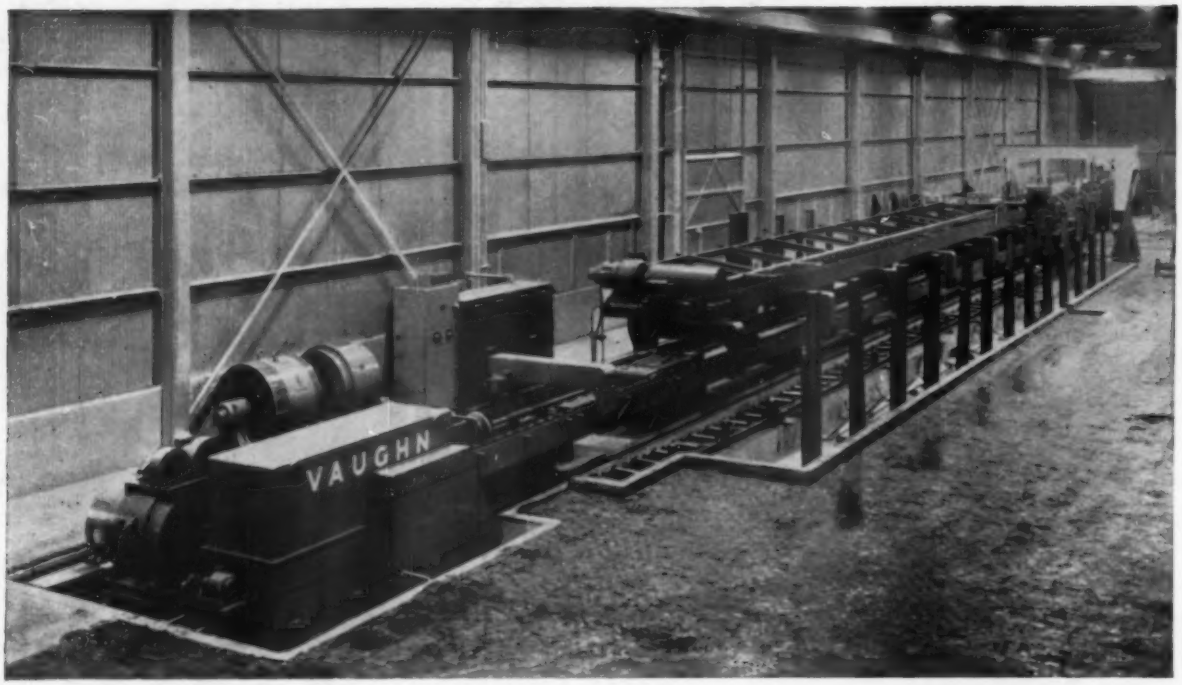

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